THE MODEL ENGINEER

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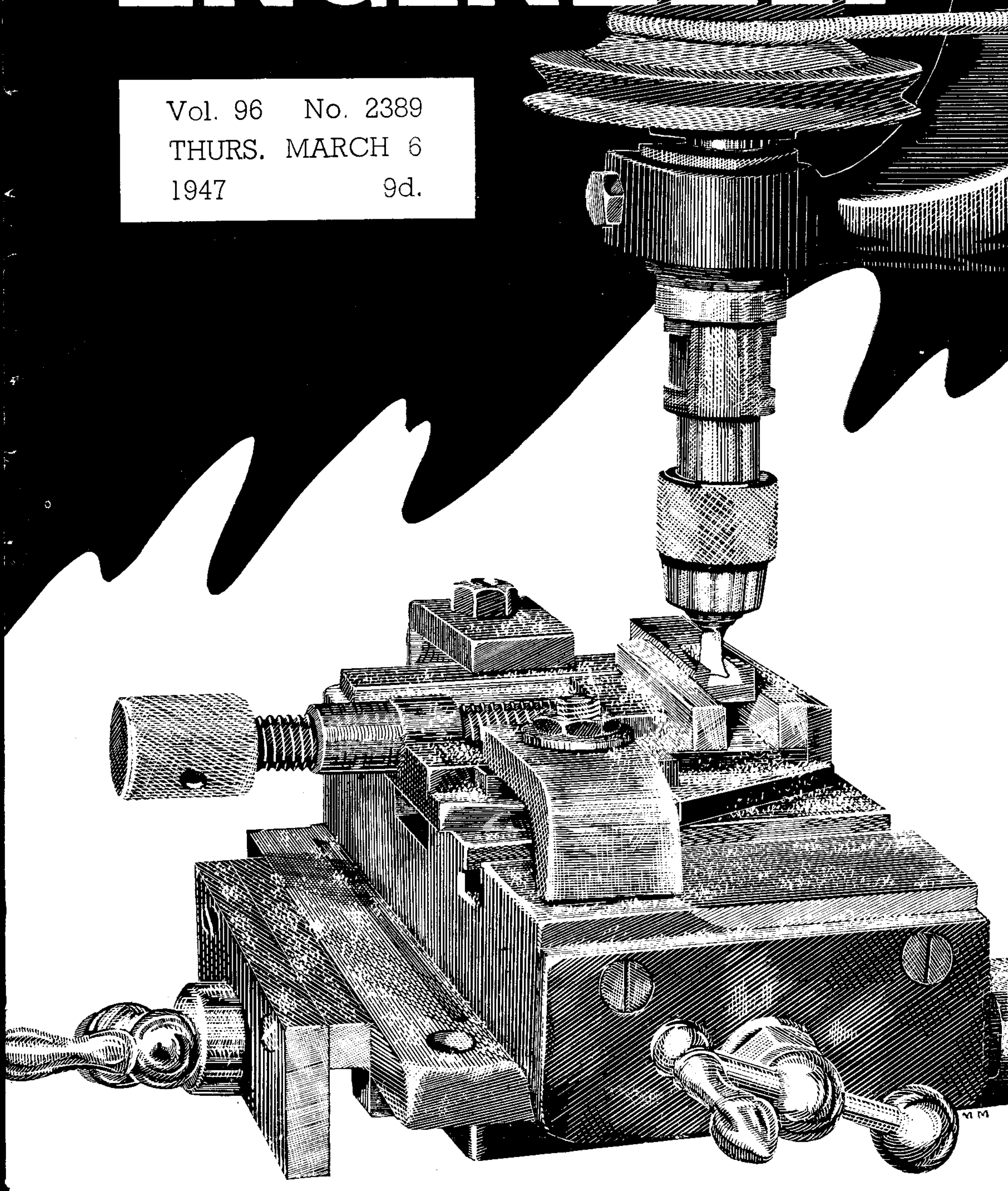

THE

MODEL ENGINEER

Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2

SMOKE RINGS

Our Cover Picture

THIS week's illustration shows a machining operation in the workshop of our contributor "Ned," namely, the milling of an undercut slot in the sliding member of an instrument component. The machine employed is a small lathe which has been converted to a vertical milling machine by the fitting of a special slide. It was fully described in Volume 82 of THE MODEL ENGINEER

The "M.E." by Candlelight

I HAVE lately witnessed a very unusual sight—the "M.E." staff with overcoats and mufflers on, working by candlelight with a grim determination that our journal after its fortnight of official suspension should reappear in all its Thursday morning glory. As I kept my own overcoat on and my fingers were so cold that my pen could hardly be persuaded to record a single paragraph for "Smoke Rings," I can, from my own experience congratulate my colleagues on their brave efforts during the great "freeze-up" to which all industries in this country have been subjected for the past month. It will, I think, be common knowledge that all weekly journals were ordered by the Government to suspend publication for two issues to save the coal and electric power required to keep the printing presses running. We, of course, came under the ban, and so for the first time in half-a-century there has been a break in the regular appearance of THE MODEL ENGINEER. The phenomenal snow-fall, the prolonged and intense cold spell, and the depleted coal stocks at the power stations have accomplished what two long war periods, including bombs and rockets, failed to do. But you can't keep a good journal down, and so here we are again, still smiling, with, I hope, the signals set for a clear road ahead. Same place, same time, next Thursday, we shall be there to greet you!

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A Change at Wigan

I HEAR that Mr. John L. Waterhouse has retired from the secretaryship of the Wigan Society, after having rendered splendid service in this capacity for the past ten years. He is succeeded by Mr. Banks, who is a keen enthusiast and a popular personality. The Society is in excellent shape, both financially and technically, and as Mr. Waterhouse tells me "all is merry and bright with a cheerful spirit everywhere." Good contacts are being maintained with the neighbouring societies at Bolton and Warrington, and the prospects of model engineering in Lancashire are very sound.

Making the Workshop Pay

FOLLOWING my recent note on this subject, there is a further point to be borne in mind by those contemplating a home industry. In most leases and agreements for the tenancy of private houses there is a clause prohibiting the carrying on of any trade or business therein without the consent of the landlord. There may also be a clause prohibiting the affixing of any plate or sign on the exterior of the premises announcing

the existence of such a business. The object of such restrictions is to preserve the general residential character of the property and to avoid any annoyance to the neighbours which trading or manufacturing operations might involve. While the carrying on of light construction or repair work in a model engineer's home workshop of the normal kind might be done quite unobtrusively, it would be well to check up on any prohibition of this kind and, if it exists, to obtain the landlord's consent to its continuance. It must be remembered that any advertising in the local press or the distribution of trade cards would call attention to the existence of a business at that address and might provoke the landlord to action. The alternative would be to rent a room or small workshop in some premises not so restricted, and carry on with the added expenses which such a move would impose.

The Problems of an Editor

THE business of editing a journal like THE MODEL ENGINEER is beset with almost as many problems and perplexities as is that of a Government trying to build up the country's export trade on the one hand and faced with the closing down of numbers of important factories for the want of coal on the other. It is much like the irresistible force meeting the immovable body, the readers who want this but don't want that, and the other readers who don't want this at all, but something quite different! I am not complaining, for my postbag, whatever it contains, is a constant source of interest and pleasure to me, as it brings me into such personal touch with my vast family of reader friends. Here, for example, is a letter from a West Country reader who bears a name of high standing in the engineering world. He writes :—

"It is not, I hope, too late to wish you every happiness and much pleasure in your work during 1947. May I also congratulate you on the success which has attended your efforts to keep THE MODEL ENGINEER abreast of the times and of fresh interest to your widely-differing classes of readers. I continue to get much profit from my regular perusal of the same, though I wish sometimes that you could manage to work in, say, an extra page of items of general engineering interest apart from the usual matter which you provide in such an efficient way. I feel that this would help towards inculcating a liking amongst your junior readers in particular for the real thing in engineering, and thus help in the recruitment of good material in the great profession which, holding as it does the premier position in this country's essential efforts to keep its industrial supremacy beyond question, needs all the help we can give."

This is a thoughtful and well-intentioned suggestion, but it puts me in a difficulty; I am all in favour of inspiring the younger generation with an interest in the achievements of the engineering world, but I am not quite sure that the pages of THE MODEL ENGINEER are the right place in which to do it, except so far as we can arouse their enthusiasm by examples of good engineering models and workshop practice. If I devoted any appreciable amount of space to general engineering articles and news I should, I am sure, quickly be told that such material could be equally well found in other journals and that it monopolised space which deprived the true model engineer of the kind of matter he needed and rightly expected to find in THE MODEL ENGINEER. To him THE MODEL ENGINEER is a precious thing, unique of its kind, with its space too valuable for any of it to be given up to extraneous engineering material. What do you think about it? I hope I don't bore you with these occasional digressions on my editorial problems, but I feel that you and I have a common interest in preserving and developing the unique reputation of THE MODEL ENGINEER, and the more we can get into conference the better we can achieve our object. Some seventy years ago an American writer, Will Carleton, produced a volume entitled "Farm Ballads," in which he included some very human and amusing verses relating to life on the prairies in the great wide West. In one of these—"The Editor's Guests"—he describes some of the visitors who invade the editorial sanctum of a small town newspaper. A farmer brings in his youngest son and explains that the lad is no use on the farm—

"But he don't take to nothing but victuals and he'll never be much, I'm afraid,
So I thought it would be a good notion to larn him the editor's trade."

The farmer proceeds to explain the reason for this suggestion—

"I used for to wonder at readin', and where it was got up and how,
But 'tis most of it made by machinery, I can see it all plain enough now.
And since the whole trade has growed easy, 'twould be easy enough, I've a whim,
If you was agreed, to be makin' an editor outen of Jim."

Then the editor explains some of the hundred and one things he has to know and do in his daily work.

"The farmer stood curiously listening while wonder his visage o'erspread,
And he said, 'Jim, I guess, we'll be goin', he's probably out of his head.'"

I read this poem many years ago, but it often comes into my mind, and I hope these few extracts may give you a smile. Anyway, keep on writing and let us hammer out our little editorial problems together. If you like to enclose a photograph of a model you have made, or a workshop hint, or even a longer article to interest your fellow readers, I shall be even more pleased.

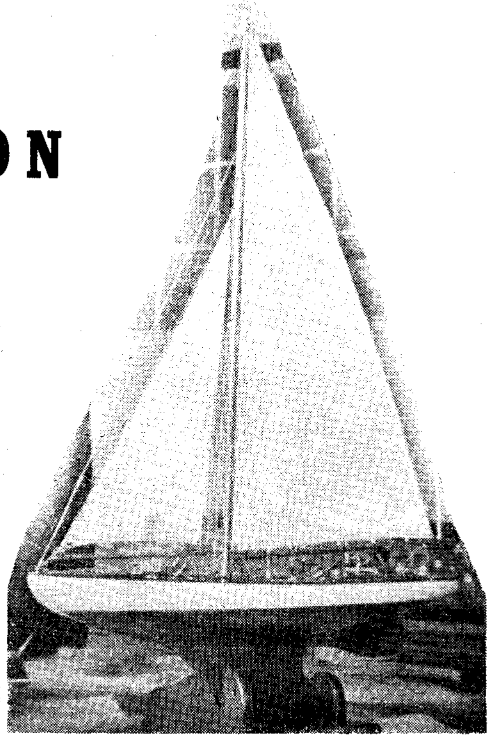
Burglars at Work

I AM sorry to hear that Mr. W. Whiting, the Hon. Secretary of the Orpington Society, has had a visit from local thieves, who have stolen a new 15-c.c. 2-stroke engine and $\frac{1}{2}$-in. scale model traction engine by Bassett-Lowke. Any news of these missing models would be welcomed by Mr. Whiting at 127, Repton Road, Orpington, Kent.

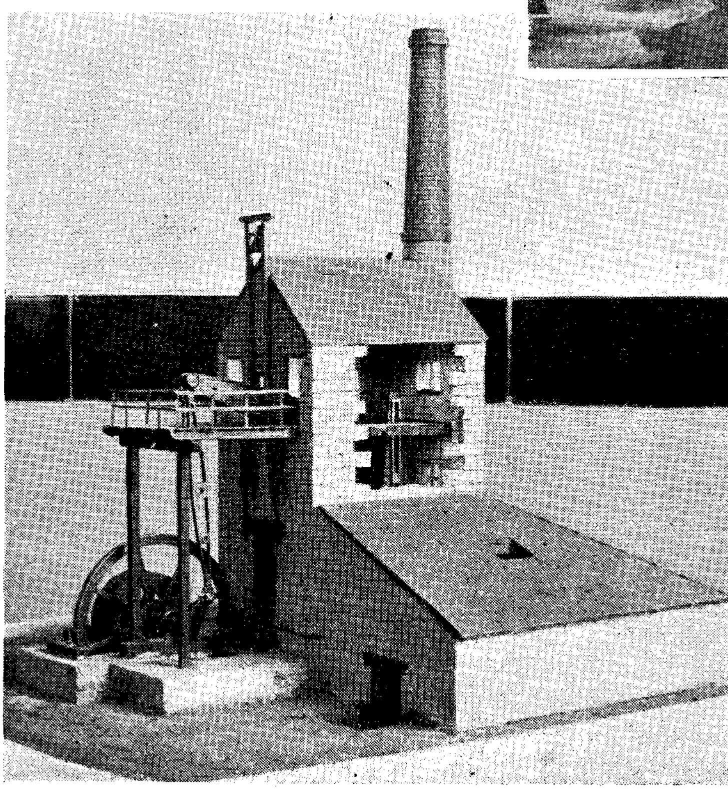
Percival Marshall

The ROTHERHAM EXHIBITION

A VERY successful exhibition of models opened the New Year programme of the Model Engineering Section of the Rotherham College of Technology Engineering Society. This society is fortunate in having the support of the Higher Education Authority of the above town, and enjoys the facilities of an excellently equipped workshop and lecture hall in the College of Technology, Howard Street, where the Exhibition was held. During the three days on which the Exhibition was open, about 2,000 people attended, and the exhibits, which numbered over 150, were arranged in five sections and represented practically every branch of model engineering interest. Passenger hauling on a 60-ft. straight track was provided by Mr. Douglas Blackburn's 1-in. scale 0-6-0 tank locomotive, and Mr. R. Kerry's $\frac{3}{4}$-in. scale 2-6-0 *Princess Marina.* Film shows on engineering subjects were given in the College lecture hall, and were well attended. The judging of exhibits in the competition section was carried out by Mr. W. D. Miller, M.B.E., president of the Brighouse M.E. Society, and Mr. Edgar T. Westbury.



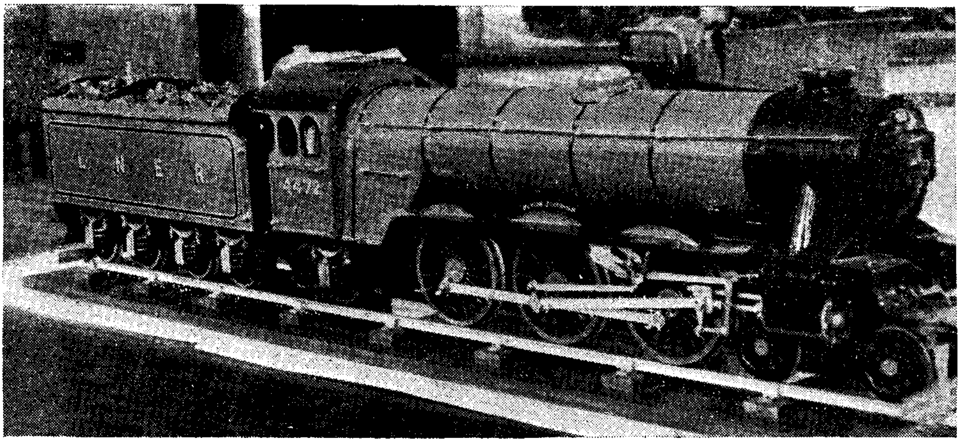
Model yacht, with laminated paper hull, by H. A. MacNab



Cornish pumping engine, by F. D. Woodall

Interesting and Unusual

Among the most interesting of the models shown may be mentioned the colliery winding engine by Mr. W. D. Hill, a rather unusual type of model which nevertheless gives plenty of scope for good workmanship and detail work. Another very realistic stationary engine was the beam engine shown by Mr. F. Woodall, a past master at the art of modelling historic engines. Locomotive models were, as usual, very plentiful,



$3\frac{1}{2}$-in. gauge 4-6-2 locomotive by W. J. Reeder

and almost without exception, were of very high quality; an outstanding model in this section was the $3\frac{1}{2}$-in. gauge *Princess Royal* by Mr. N. Nicholson, of the Sheffield S.M.E. Another model from this society, Mr. S. Breedon's showman's traction engine, was universally admired, and its fine workmanship and finish were shown to good advantage by skilful lighting.

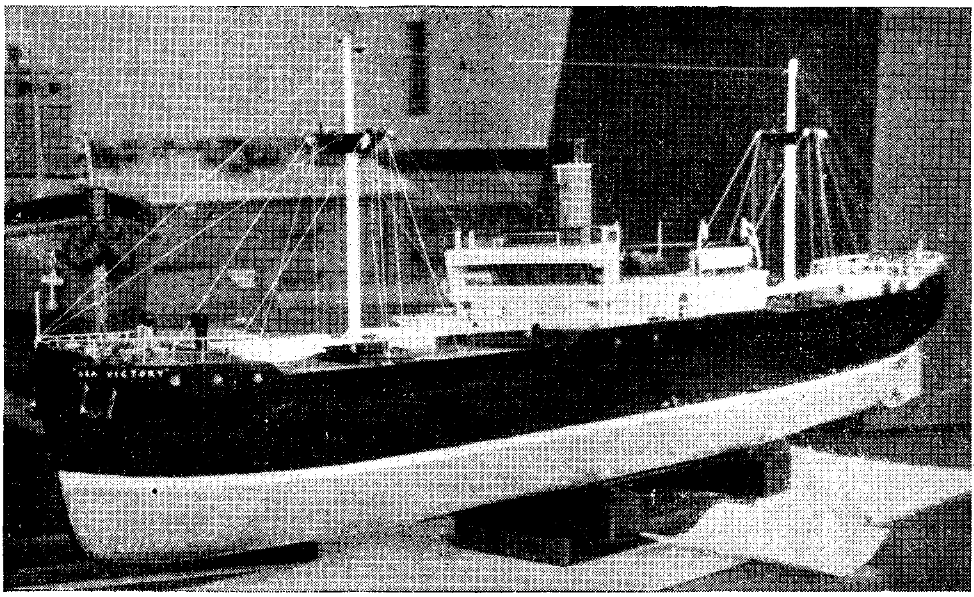
At least two of the marine models call for special mention: the electrically-driven cargo steamer *Sea Victory*, by Mr. J. Dent., in which excellent workmanship in both hull and superstructure, combined with careful attention to rigging and deck fittings, produced a very realistic effect; and the model sailing yacht, by Mr. H. A. Macnab, the hull of which is built of laminated paper, both the general contour and the finish being all that could be desired.

The model aircraft section included several flying models, gliding and powered types, also solid scale models; of the latter, a collection of 42 miniature historic models, representing practically a complete history of aviation, by Mr. D. Sheeran, were of outstanding interest.

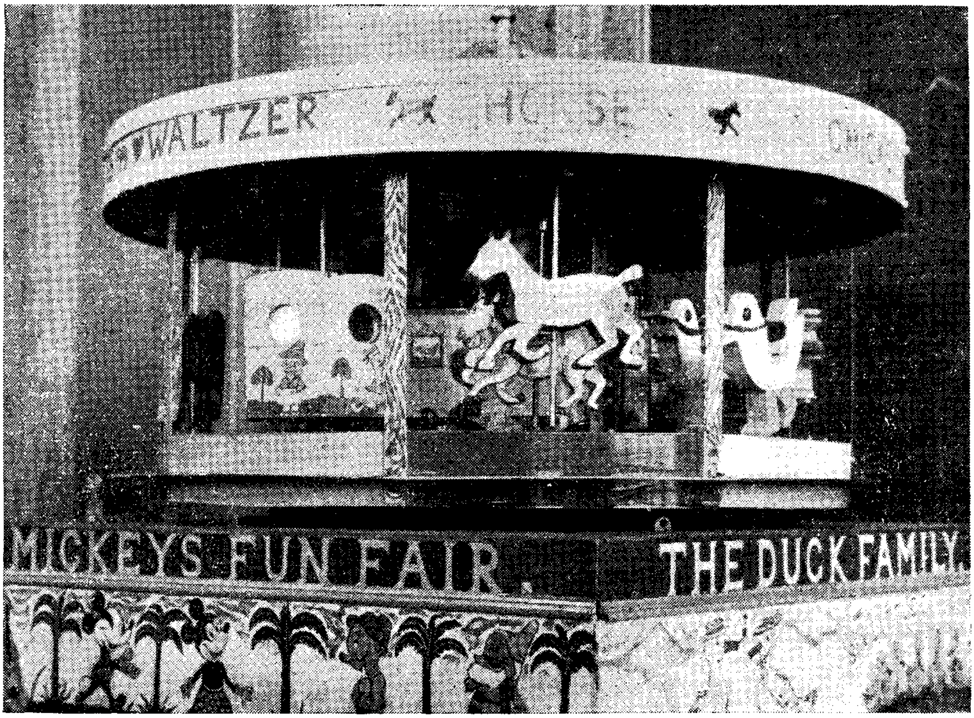
Tools

Some very good work was also exhibited in the

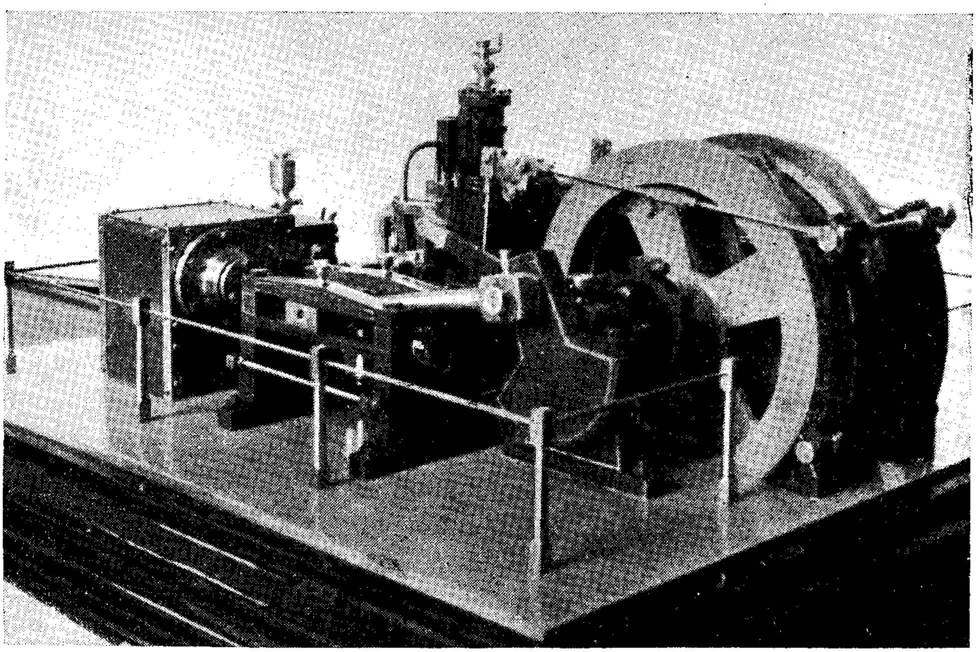
(*Continued on page* 258)



Electrically-driven model cargo steamer by J. Dent



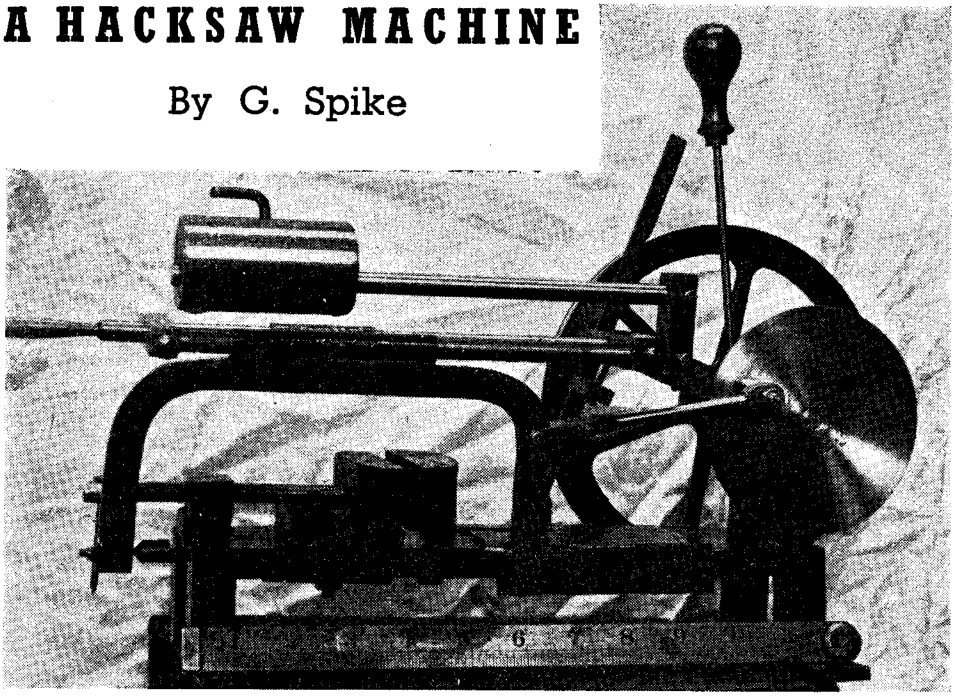
Model merry-go-round, electrically driven, by C. Walker



A model colliery winding engine by N. D. Hill

A HACKSAW MACHINE

By G. Spike



HEREWITH is reproduced a photograph of a hacksaw machine, which I have made, and I hope it will be of interest to other model makers.

The saw is made of odds and ends; the base is mild-steel 12 in. × 3 in. × $\frac{1}{2}$ in. thick; the frame is made out of a piece of mild-steel $\frac{1}{2}$ in. × $\frac{1}{4}$ in., bent to shape, and has a piece of tube brazed on the top to take a $\frac{3}{8}$-in. round bar. All the guides are $\frac{3}{8}$-in. bars.

The vice is made out of pieces of mild-steel, brazed together with a 1-pint brazing lamp.

The saw is fitted with an automatic stop, and stops itself when it has sawn the piece through.

The blades used are the small model-makers' saws.

The machine will saw a piece of $1\frac{1}{2}$-in. shaft off in quick time and saves a lot of hard work.

I would be pleased to help anyone who might wish to make a similar machine, if he writes to me *via* THE MODEL ENGINEER Offices.

The Rotherham Exhibition

(*Continued from previous page*)

tool section, including a very useful-looking $1\frac{5}{8}$-in. lathe, with many detail refinements, by Mr. A. Barker, and an example of THE MODEL ENGINEER drilling machine by Mr. A. H. Senior, an engineering apprentice whose work shows great promise. A very fine lathe tailstock, the body of which was cut from a 56-lb. weight, by Mr. S. Ellis, and a bench grinder, similar to THE MODEL ENGINEER bench grinder, but fitted with ball bearings and vee belt drive, were also prominent in this section.

A very novel exhibit, which was shown in motion, was the model roundabout by Mr. C. Walker, in which were featured not only horses, but also a wide variety of other animals, including familiar Walt Disney characters. The painstaking care taken in the painting of this model and its furnishings was typical of the best examples of the showman's art, and great ingenuity was also displayed in the mechanism for imparting " galloping " and other movements to the figures.

The awards were as follow :—

True scale models : 1, D. Sheeran (aeroplane) ; 2, W. H. Tunnicliffe (L.N.E. locomotive) ; 3, W. H. Tunnicliffe (L.N.W. locomotive).

Working models : 1, D. Hill, of Wath (winding engine) ; 2, A. Cox, of Kilnhurst (locomotive) ; 3, H. A. Nacnab (sailing yacht).

Representative models : 1, J. Wilson (aeroplane) ; 2, J. Dent (tramp steamer) ; 3, F. Woodall, of Keighley (beam winding engine).

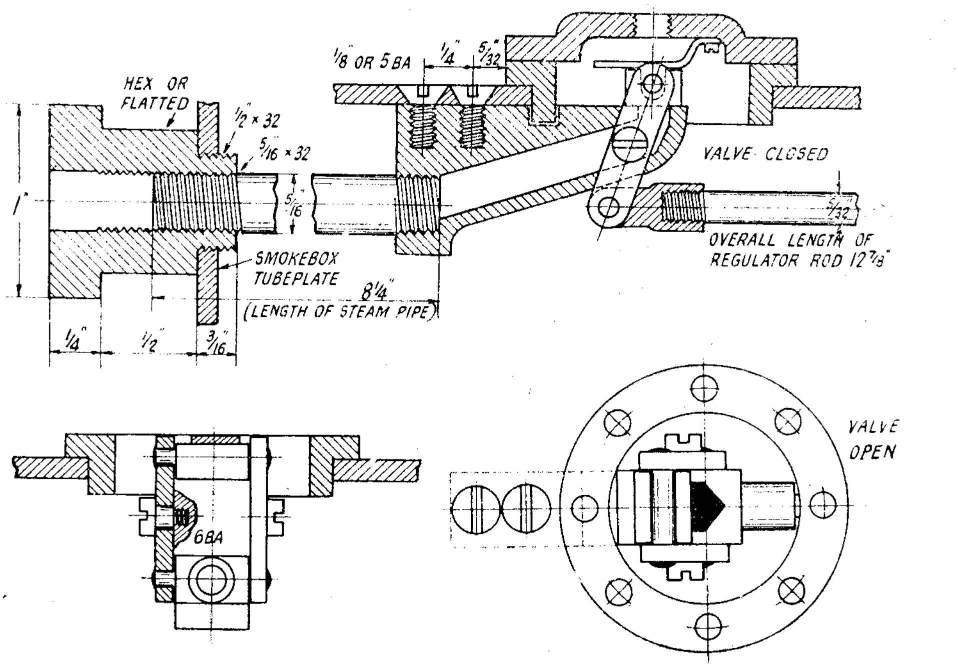
Tools : 1, A. H. Senior, of West Melton (sensitive drill) ; 2, A. Barker, of Sheffield (lathe) ; 3, H. S. Ellis (tailstock).

"L.B.S.C."

Regulator for "Hielan' Lassie"

YOUR humble servant had quite a lot of cerebral exercise before deciding on a suitable easily-made type of regulator for this locomotive. The full-size A3 class have a double-beat regulator in a pimple-sized dome, operated by a bell crank underneath the actual valve; this is connected to a cross rod on the backhead having a handle at each end, the connection between longitudinal and cross rods being entirely enclosed. The idea of the latter arrangement is to prevent the regulator flying open by virtue of steam pressure on the end of the rod; a trouble very common with the ordinary type of pull-out regulator. The late Bill Irvin very nearly sustained a broken jaw one afternoon at Finsbury Park, when the regulator of the Great Northern tank engine he was driving at the time, suddenly flew wide open, and his unfortunate noddle happened to be close to the handle, right in the "line of fire." American pull-out throttles usually have a quadrant, trigger and latch, to make them "stay put." Personally, I don't care a little bit for the pull-out regulator, having been born and raised, in a manner of speaking, on the quadrant type, and the good old Stroudley pattern at that; but I guess if I specified a quadrant type for the "Lassie," Inspector Meticulous and all his friends and relations would loose off a most terrific howl, and I heard enough howling from the air-raid sirens to last the rest of my life!

We can't copy the regulator of big sister for several reasons; No. 1 is that I don't suppose one builder in a hundred would get both the upper and lower valves and seatings tight. The valve itself is like a glorified cotton spool or bobbin, mounted on a vertical rod, and seatings are formed in the top and bottom of the casting, to match the ends of the bobbin. Both ends of the latter have to make steam-tight contacts with their respective seatings at one and the same time; and even if a patient and persevering worker spent a week turning the seatings on the bobbin to an exact fit for the seatings in the regulator head, ground them in, and got a perfect contact on both, at one and the same time, it is a pretty safe bet that when the boiler reached working temperature, the expansion of both valves and seatings wouldn't be equal, and naturally one would leak. That puts the little double-beat regulator out of court right away. Then there is the trouble at the backhead end. It would need a much stouter than "scale-size" cross-rod, arm and forks to make the job strong enough to stand up to the usual handling these little engines have to put up with; and by the time we had covered over the whole doings with a steam-tight casing and a gland at each side, the excrescence



Section, end view and plan of regulator

on the backhead would be akin to Ally Sloper's famous proboscis, and just about as pretty. Then the cross-rod and the two handles would run foul of the other backhead fittings. So, taking it by-and-large, I thought it advisable to "can" the idea of a regulation Gresley throttle, and substitute a Curly type instead. I have retained the pull-out arrangement, to stop the howls before they started, as Patrick would remark; the handle doesn't get in the way of anything on the backhead, it isn't unsightly, and the whole bag of tricks is quite easy to make and erect. The valve itself is a simple slide-valve operating over a shaped port in a block; it is arranged horizontally, and takes steam from the highest possible point. Also, last but decidedly not least, it is easily lubricated.

Throttle Block

Castings may be available for this; if so, there will be a blob each side at the point where the steam pipe is screwed in. Alternatively, the block may be cut from a piece of ⅜-in. by ⅞-in. brass bar, sawn and filed to the shape shown in the sectional illustration. The finishing-off is the same in both cases. On the centre-line of the wide end, at 17/32 in. from the top make a centrepop, drill it to a depth of about ¼ in. with 7 mm., letter J, or 9/32-in. drill, and tap it 5/16 in. by 32 or 40. Note—on a block sawn from bar metal, be mighty careful to have this hole dead on the centre-line, as there will be only 1/32 in. of solid metal each side of it; whereas on a casting, the sides will be thickened by the blobs already mentioned. At 3/16 in. from the narrow end, on the centre-line on top of the block, drill a No. 30 hole about 3/16 in. deep; then drill a diagonal hole with a 7/32-in. drill, from the upper part of the tapped hole, until it meets the small vertical one. Next, with a little chisel made from a bit of ⅛-in. silver-steel, chip away the metal around the vertical hole, to form the port shown in the plan views. On the side, at 5/16 in. from the narrow end and 7/32 in. below the top, drill a cross hole with No. 44 drill, and tap it 6-B.A., right through the block. This hole will cut across the steam way, but that doesn't matter, because the screws holding the levers close both ends securely. Lastly, file the nick shown.

On the centre-line of the top of the boiler barrel, in front of the dome bush, drill two No. 30 holes and countersink them, for the screws holding the block in place. The first is 5/32 in. ahead of the bush, and the second ½ in. farther along. Now insert the block temporarily in place, putting it in wide end first, and tipping it up. If you have any difficulty holding it in place with pliers, put a few threads on the end of a bit of 5/16-in. rod, or the steam-pipe, poke it through the hole in the smokebox tubeplate, and support the block with that, screwing the rod into the steam-pipe hole. Put the No. 30 drill down the screw-holes and make small countersinks on the block, or mark with scriber, as you prefer. Remove the block, drill the marked places No. 40, and tap ⅛ in. or 5-B.A. Take off the sharp edge at either side of the top of the block, where the screw-holes are, ahead of the nick; the section where the port is must be carefully faced truly, same as the port faces of the cylinders, and you should recollect how you did that job

Slide Valve

The slide-valve is a little block of gunmetal or bronze, 3/16 in. high, ⅜ in. long and 9/32 in. wide. The easiest way of cutting the groove for the actuating pin is to drill a No. 30 hole lengthwise through the block, saw down to it each side, and trim up with a file. The bottom is faced in the same way as the engine slide-valves. There is, of course, no cavity to cut.

Actuating Gear

The valve is operated by two double-armed levers, one at each side of the block, pivoted on shouldered screws seated in the holes already mentioned. There is a connecting-piece or crosshead at the bottom, into which the regulator rod is screwed. A pin passes through the top of both, and lies in the groove in the slide-valve, so that any movement of the regulator handle is transmitted *via* the rod, crosshead, levers and pin, to the slide-valve. Any non-rusting metal—brass, copper or bronze, either nickel or phosphor, will do for the levers; cut them to the size given in the illustration, and either drill both together, or mark out and drill one, then use it as a jig to drill the other. File off any burrs.

The connecting-piece, or crosshead, is made from a piece of ⅜-in. by ¼-in. brass rod. Chuck truly in four-jaw; face, centre, drill down ¼ in. with No. 30 drill, and tap 5/32 in. by 40. Turn down ¼ in. length to ¼ in. diameter, and part off ⅝ in. from the end. At ⅛ in. from the end, drill a No. 30 cross hole; round off the end with a file, and slightly reduce the thickness to 7/32 in. as shown. Next turn up the two pins for connecting the levers; these are pieces of ⅛-in. round rod, bronze for preference, although brass will do, and are 11/16 in. full length, with 5/64 in. of each end shouldered down to a tight fit in the holes in the ends of the levers. The distance between the shoulders must be ⅜ in. full, so that the levers, when assembled, slip easily over the throttle-block and valve, without being too slack. Rivet one pin into each end of one lever; put the crosshead over one of the pins, then put on the other lever, and lightly rivet over the ends of the pins.

Turn the shouldered screws from a bit of ¼-in. bronze rod held in three-jaw. First turn down about 3/16 in. length to ⅛ in. diameter, to fit the centre holes in the levers; then turn down a bare ⅛ in. of the end to 7/64 in. diameter, and screw 6 B.A. The plain part should be just wide enough to allow the lever to swing freely when the screw is right home, with its shoulder hard against the throttle-block. Part off to leave a head about ⅛ in. wide, and slot it with a thin hacksaw blade. To assemble, put the valve under its pin, slide the whole doings over the narrow end of the throttle-block, and put the screws through the holes in the levers, with a taste of plumbers' jointing on the threads, carefully washing away any surplus with a brushful of paraffin. Put the complete assembly back in the boiler again (and don't let go of it, or the dictionary of railroad Esperanto will need complete revision to bring in some additions) and secure the block to the barrel with two contersunk-head bronze or brass screws. It may need a little careful connivering to locate and hold the block, but the before-

mentioned screwed rod will help ; and remember that patience is a virtue, as the cat thought whilst sitting for the fifth night in succession, beside the mouse-hole.

Steam-pipe and Flange

The steam-pipe is a piece of 20- or 18-gauge copper tube $\frac{5}{16}$ in. diameter and $8\frac{1}{4}$ in. long. One end is screwed $\frac{5}{16}$ in. by 32 for a bare $\frac{1}{2}$ in., and the other screwed for about $\frac{3}{16}$ in., the same pitch as the thread in the throttle block. Anoint this end with a smear of plumbers' jointing, and screw it home into the block, through the hole in the smokebox tubeplate. Some folk prefer to notch the end, but all I ever do is to jam the end of a round file in the end of the tube, which locks itself and allows the file to be used like a screwdriver. The file frees itself when turned backwards ; it always obliges me, at any rate !

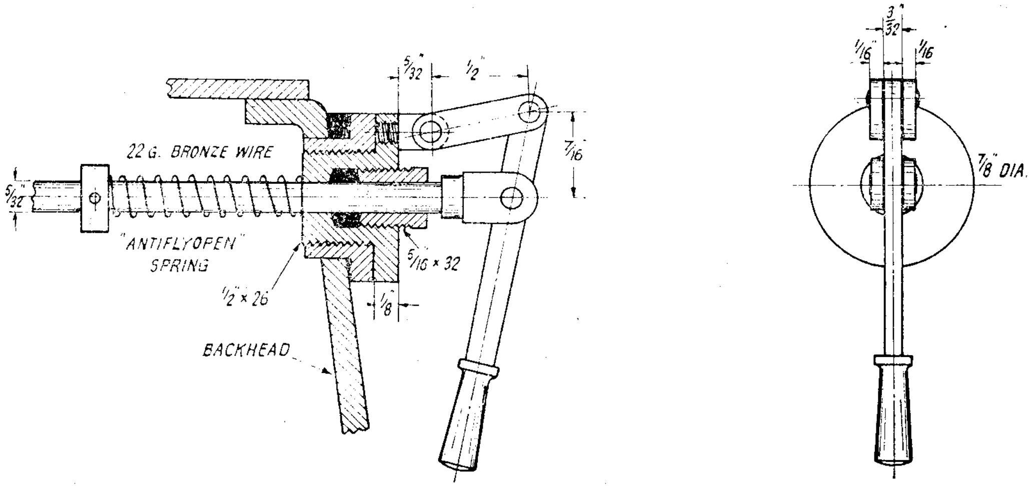
Castings should be available for the steam flange fitting, and the section behind the contact face will be hexagon, to allow for easy screwing home. Chuck in three-jaw by the big flange, and set to run truly. Face, centre, drill right through with 7-mm., letter J or 9/32-in. drill, and tap $\frac{5}{16}$ in. by 32. The tap need not go right through ; see sectional illustration. Turn down $\frac{3}{16}$ in. of the outside to $\frac{1}{2}$ in. diameter and screw $\frac{1}{2}$ in. by 32. Reverse in chuck, gripping by centre part ; face off the flange, and turn the outside to 1 in. diameter.

The flange fitting can also be turned from 1-in. brass rod ; in that case, either file the centre part hexagon, or file a flat on each side to take a spanner. Put a smear of plumbers' jointing on the threads, and on the steampipe, whch should be just projecting from the hole in the tubeplate ; then screw the fitting on the end of the steam pipe. When the external thread meets the tubeplate, it will engage with the thread in the tapped hole ; and being same pitch as the thread on the steam-pipe, the whole issue will be locked solid when the shoulder is hard up against the tubeplate. I have used this form of flange for 25 years or more, and never had one leak or fail in any way whatever.

Backhead Fittings

The regulator-rod is a piece of 5/32-in. round brass or bronze, $12\frac{7}{8}$ in. long, screwed 5/32 in. by 40 at both ends. A small brass collar $\frac{3}{8}$ in. diameter and about $\frac{3}{16}$ in. wide, is driven on 2 in. from one end, and pinned by a bit of $\frac{1}{16}$-in. brass or bronze wire driven through a No. 53 hole drilled through collar and rod. The rod is inserted through the bush on the backhead, and screwed into the boss on the crosshead between the levers at the sides of the throttle block. You can easily hold the boss with a bit of hooked wire whilst starting the thread. The collar should be at the back end.

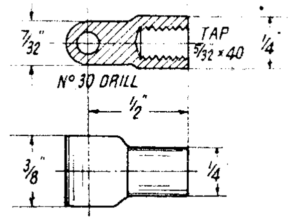
To make the gland fitting, chuck a piece of $\frac{7}{8}$-in. brass or bronze rod in three-jaw. Face, centre, and drill about $\frac{5}{8}$ in. depth with No. 21 drill. Turn down $\frac{3}{8}$ in. of the outside to $\frac{1}{2}$ in. diameter and screw $\frac{1}{2}$ in. by 26. Part off at $\frac{1}{2}$ in. from the end. Reverse in chuck, holding either by the threads or in a tapped bush, and open out the No. 21 hole to 9/32 in. for $\frac{3}{8}$ in. depth ; tap $\frac{5}{16}$ in. by 32 or 40, and take a skim off the face to true it up. Make a gland from $\frac{5}{16}$-in. hexagon brass rod, using this size to keep the head as small as possible. Screw the fitting right home, and mark which is the top ; then, at a bare $\frac{1}{8}$ in. from the top, on the centre-line, make a centrepop. Remove fitting, drill the pop with No. 44 drill and tap 6-B.A. Make a little lug just the same as the lugs on the smokebox door, the stem being screwed 6-B.A., and the lug itself made 3/32 in. in thickness and a bare $\frac{1}{4}$ in. wide. Drill it No. 30, and screw it into the flange. This can now be screwed home "for keeps" ; but before doing so, put a spring, wound up from 22-gauge phosphor-bronze hard spring wire, over the regulator rod, letting it go up against the collar. This should come about level with the face of the bush when uncompressed. Put an oiled paper washer over the gland fitting, and screw it right home, the little lug being at the top. The action of screwing home the fitting will compress the spring sufficiently to prevent any tendency of the regulator to fly open when the boiler is in



Regulator gland and handle

steam and there is pressure on the end of the rod. Pack the gland with a few strands of graphited yarn, and screw the gland nut in fairly tight, but not tight enough to bind on the rod.

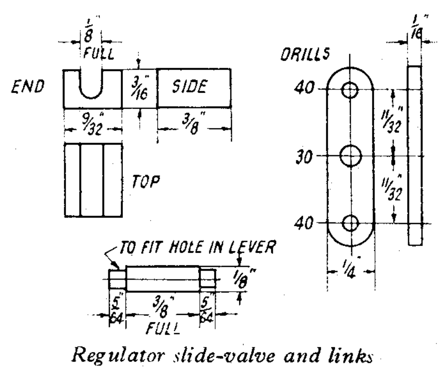
The arrangement of handle and connecting links is pretty much the same as on the tender



Crosshead for regulator rod

pump, only in reversed order. The regulator handle is made from a 2-in. length of $\frac{1}{4}$-in. round rod; rustless steel would be best, or failing that, nickel-bronze (the stuff we used to call German silver), but ordinary mild steel will do if nothing else is available. Chuck in three-jaw, turn the handle either to shape shown, or to your pet fancy, then file the rest flat, to a thickness of 3/32 in. and slightly taper. Drill two No. 30 holes in it $\frac{7}{16}$ in. apart, as shown, and attach it to the lug on the gland flange by two links like the pump links, filed up from $\frac{1}{4}$-in. by $\frac{1}{16}$-in. strip, same kind of metal as the regulator handle if possible. The links are drilled No. 32; the pins are made from $\frac{1}{8}$-in. round rod, any metal, and squeezed through the holes in the links. They should be a nice working fit in the holes in both regulator handle and lug. Bolts may, of course, be used if desired, made from $\frac{1}{8}$-in. round rod, and shouldered down to take a 3/32-in. nut each end, for neatness sake; but I prefer pins. A fork or clevis is made from $\frac{1}{4}$-in. square rod, exactly the same as those described for the valve-gear, and screwed on to the end of the regulator rod, the handle passing between the jaws, as shown in the illustration, and being secured either by a pressed-in pin or by a bolt with reduced ends and nuts as mentioned above.

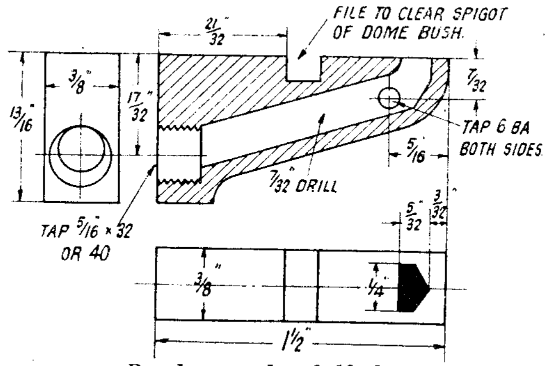
When the handle is pushed right in as far as it will go, the crosshead on the front end of the regulator rod comes up against the underside of the throttle block, which acts as a stop; the levers incline backward, and move the valve so that it completely covers the steam port, overlapping by about $\frac{1}{16}$ in.



Regulator slide-valve and links

each end; and if the valve and the block have been truly faced, there won't be any suspicion of steam leakage. On pulling the handle the valve first uncovers the apex of the triangular-shaped port, thus ensuring a gradual admission of steam; and unless the driver is what is commonly termed a "hamfisted mutt," the engine should get off the mark with its maximum load, without the ghost of a slip. There is no real need to provide any stop for the full-open position, as the valve cannot run off the port-face, and will come up against the bush (see plan diagram) if the handle is pulled too far; but unless steam is allowed to fall to a low pressure, the regulator will very seldom have to be opened fully!

To prevent the valve falling off the port-face when the engine is turned upside down for any reason, and thus allowing grit or scale from the water to get between the sliding faces and cause leakage, a small flat spring, made from thin bronze strip (the kind used for coiled brush springs on electric motors and dynamos is just "the very identical") is attached to the inside of



Regulator or throttle block

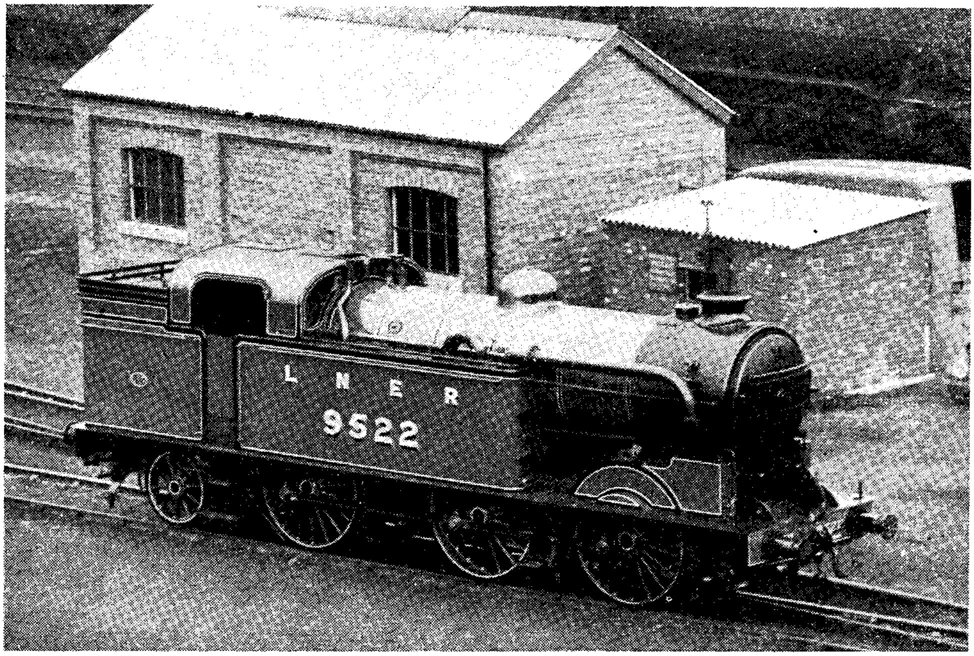
the dome cap by a single 3/32-in. brass screw, as shown in the sectional illustration of the complete regulator. This does not need to press on the valve very hard; just sufficiently to keep the sliding surfaces always in contact. A spot or two of cylinder oil introduced through the screwed plug on the top of the dome cap, every now and then, will ensure adequate lubrication and prevent any case of sticking or leaking regulator-valve. Don't overdo it, and drop oil inside the boiler, or your water gauge will promptly begin to emulate Ananias.

Misfortunes Never Come Singly!

Imitation, they say, is the sincerest form of flattery; my 3-in. Boley lathe must have a sincere admiration for its Milnes confrere, because no sooner did I get the Milnes tail bearing O.K., than the Boley developed tail trouble! The mandrel had been running noisily for some time, but as the work was not affected in any way, I let it bide. However, last week, time of writing, the noise suddenly developed into an awful rattle, and the work went out of truth. I promptly yanked out the mandrel and discovered the reason. The ball thrust bearing consists of the usual brass cage of balls sand-

(*Continued on next page*)

A BRIGHTER OUTLOOK!



THROUGHOUT the British railway workshops strenuous efforts are being made to cope with unprecedented arrears in the repair and overhaul of locomotives, quite apart from the building of badly-needed new ones. The above illustration, reproduced from an official photograph, shows a L.N.E.R. "N2" class 0-6-2 suburban tank engine just out of the shops and once more ready for service after undergoing heavy repairs. But what, perhaps, is more pleasing from the point of view of the average onlooker, she has been repainted in the bright apple-green livery which she has not known for many years.

Regulator for "Hielan' Lassie"

(*Continued from previous page*)

wiched in between the flange of the coned tail bearing, and a hardened washer held by a couple of lock-nuts; the flange takes the thrust direct from the balls, no separate race being provided, and the balls making line contact only. Three small pits had developed in the ball track; and the balls, bumping over them, caused both the noise and irregularity.

I couldn't get a new tail bearing cone, because the R.A.F. closed the shop where the machine was made in Jerryland, and they haven't reopened yet; so the only thing to do was to fit an ordinary thrust bearing. Unfortunately, there is no standard size of thrust bearing that will fit; but by the kind offices of a friend in Chelmsford, I was enabled to obtain immediate delivery of a Hoffman E4, consisting of a small cage of balls with a thin hardened washer at each side, the balls making line contact. This by itself wouldn't have been stout enough, so I put one of the washers against the defective flange of the tail bearing, and the other against the original thrust washer on the other side; and instead of putting the Hoffman cage of balls in between, I knocked out all the balls from the Jerry cage (there were about twice as many) and replaced them by entirely new balls. The reconditioned Jerry ball cage was then placed between the Hoffman washers, and the whole issue reassembled and adjusted. The Hoffman washers thus form two new ball tracks between the original Jerry tracks, and with the new balls, the whole issue is restored to new condition; the machine now runs quite silently, the mandrel being perfectly free, and the work turned out is fully up to original precision standards.

AUTOMATIC STEERING
FOR MODEL STEAMERS
By Lieut.-Colonel A. G. Bates

A FIRST attempt to equip a 5-ft. ship with compass-controlled steering was described in issue No. 1962 of December 15th, 1938. The ship was a $\frac{1}{8}$-in. to 1-ft. model of SS. *Malancha* and the principle used was to allow yawing of the ship's head to illuminate one or other of a pair of selenium cells connected in a Wheatstone bridge circuit, thus upsetting the circuit balance and, through appropriate relays, causing a solenoid to move the rudder to counteract the yaw. The job was crude, but it certainly worked.

If our Editor will allow me to deviate for a moment from engineering to psychology, many of us ordinary readers have wondered wherein lies the very unique friendliness which has for years hovered round THE MODEL ENGINEER. Is it an attribute of the craft, or of leadership, or what ? I don't know, but now that we have finished with Hitler it will be a worthwhile aim to go on encouraging this spirit in every way. Anyhow, the description of *Malancha* gave me one more proof, if that were needed, and in what follows I owe much to Mr. L. G. Brough, whose radio-controlled *Winchester Castle* will be remembered by Newcastle readers.

Acting on information obtained, as they say elsewhere, plans were laid in 1939 for *Mark II*, which was to embody both auto-steering and radio control. First a hull had to be designed, and in view of the greater displacement and improved rough-weather performance which were essential, it was decided to free-lance and to take liberties with draught and sheer, while still making a ship which might be easy to look at. For reasons of transport, overall length was restricted to 64 in. and enough working freeboard had to be maintained at the estimated maximum displacement of 50 lb. This could, of course, have been done by adopting blunt-ended and slab-sided lines, but with only some ten watts available for propulsion, speed would have been too low or, if more speed had been obtained by allotting more watts (and weight), the hull would have been obviously over-driven.

Since every pound saved in weight of hull was going to ease the displacement problem, it was decided to make the hull of paper instead of sheet brass as used for *Malancha*. Tinplate might have been as light, but was barred in view of the presence of the magnetic compass. Paper had another advantage, although this was not foreseen. It was, in fact, about the only method which could have allowed two boys then aged seven and five to lend an effective hand in building.

Sections were drawn for every 2 in. of the ship's length ; these were transferred to plywood, using carbon paper and the plywood sections sawn out. These in turn were erected on a stout elm baseboard 5 in. wide by $2\frac{1}{2}$ in. thick and the whole contraption looked like a colossal toast-rack. A stem bar and stern frame of wood were added. Tests were made for fairness by laying a thin flexible lath along successive waterlines, and a few adjustments were made with a cabinet rasp.

Paper plating—or should it be hanging ?—began with strips of newspaper, some 3 in. wide, laid on the skew from one bulwark over the ship's bottom to the other bulwark at about 45 deg. to the fore and aft line. Each strip was parallel to its predecessor, which it overlapped, and was fastened to its neighbour and to the edges of the plywood sections with glue. On completing one layer, the next was begun on the opposite skew, thus crossing the first at right angles. Regions of sharp curvature, such as the cruiser stern, were built up out of patches, hope and much glue. Some three skins were put on in this way, but on drying out, the paper sagged horribly between the plywood sections, which stood out like the ribs of a starved cow. Accordingly, thread was wound round the ship from stem to stern before adding further paper. This and a good coat of shellac varnish every two skins helped a lot, and after about half-a-dozen effective skins newspaper was abandoned in favour of gummed brown-paper strip as sold for parcelling. In all, some fourteen skins of brown paper, with two of calico strip, went on before the hull sounded and felt as does a papier-mâché bowl.

The baseboard and plywood sections were removed and all soft paper inside scrapped away. It was then found that where the lines were hollow, only the paper skins lying outside the calico were in full contact, and scraping had to be continued until a sound surface was reached. These excavations were readily filled with plastic wood, which was also used to reinforce the fore-peak and stern-tube. After fitting strong battens longitudinally at main deck level and inserting temporary deck stringers, the hull was surprisingly rigid and light. There remained the lengthy job of painting, rubbing down, filling in and again painting—seemingly until seventy times seven—before a reasonably fair outer surface was obtained.

Parallel with hull building, plans for the innards were prepared, and some bits and pieces had been collected or made when Hitler upset all our lives. In the hurry of mobilisation, time was still found to pack everything belonging to *Mark II* into cases, which happily survived the upheaval of storing when the house was requisitioned.

It was some four years later that those cases were dug out. How strange the contents looked. They almost belonged to another existence. But man cannot remain wholly sane on a perpetual mental diet of war emotion, and continuation of *Mark II*, whiles and at odd times, was a good antidote.

To cut the cackle and get down to the 'osses,

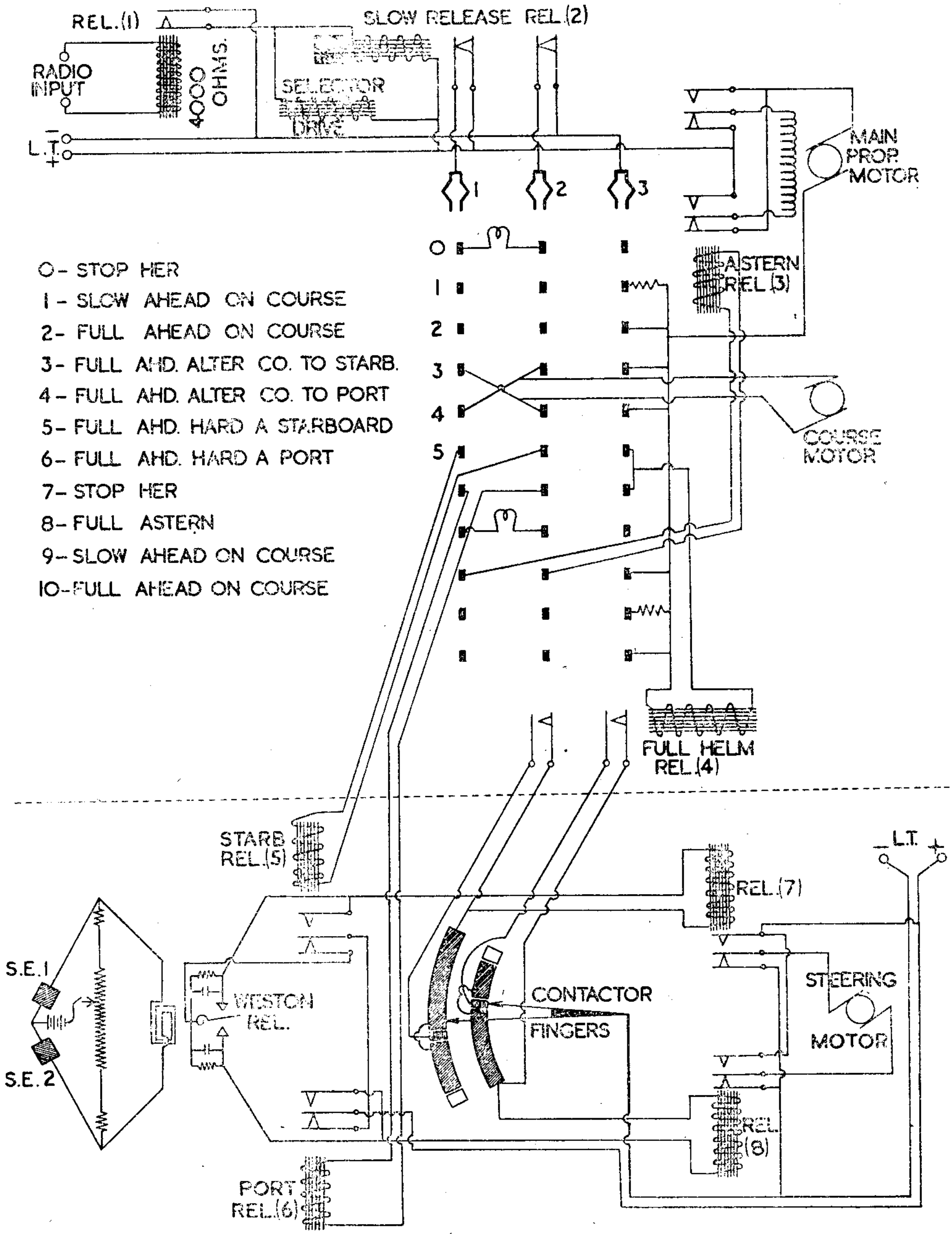


Fig. 1

the following were the main features of the machinery :—

(*a*) A liquid-filled compass to give stable steering in heavy weather.

(*b*) Motor-driven rudder in place of solenoid operation, with arrangements for restricting the amount of rudder movement when on auto steering, while retaining the use of full helm for manoeuvring.

(*c*) Some degree of speed control.

(*d*) Arrangements for astern running.

(*e*) Remote control of all movements by radio.

Control

The circuit details for all except the radio link are shown in Fig. 1. This may look rather fear-

some, but taken in bits it is not so bad.

The radio control involves a sequence switch or selector, each separate position of which corresponds to one particular bridge order. A change from one position to any other requires the receipt on board of the correct number of wireless pulses. It follows that the number of different orders is limited to the number of positions of the selector. The example available has eleven positions and in each position three separate contacts can be made or broken. They are represented diagrammatically by the heavy type portions of the diagram which lie above the horizontal dotted line. The three pincer-like objects (numbered 1, 2 and 3) are three wipers which pass successively from position 0 to 10 and

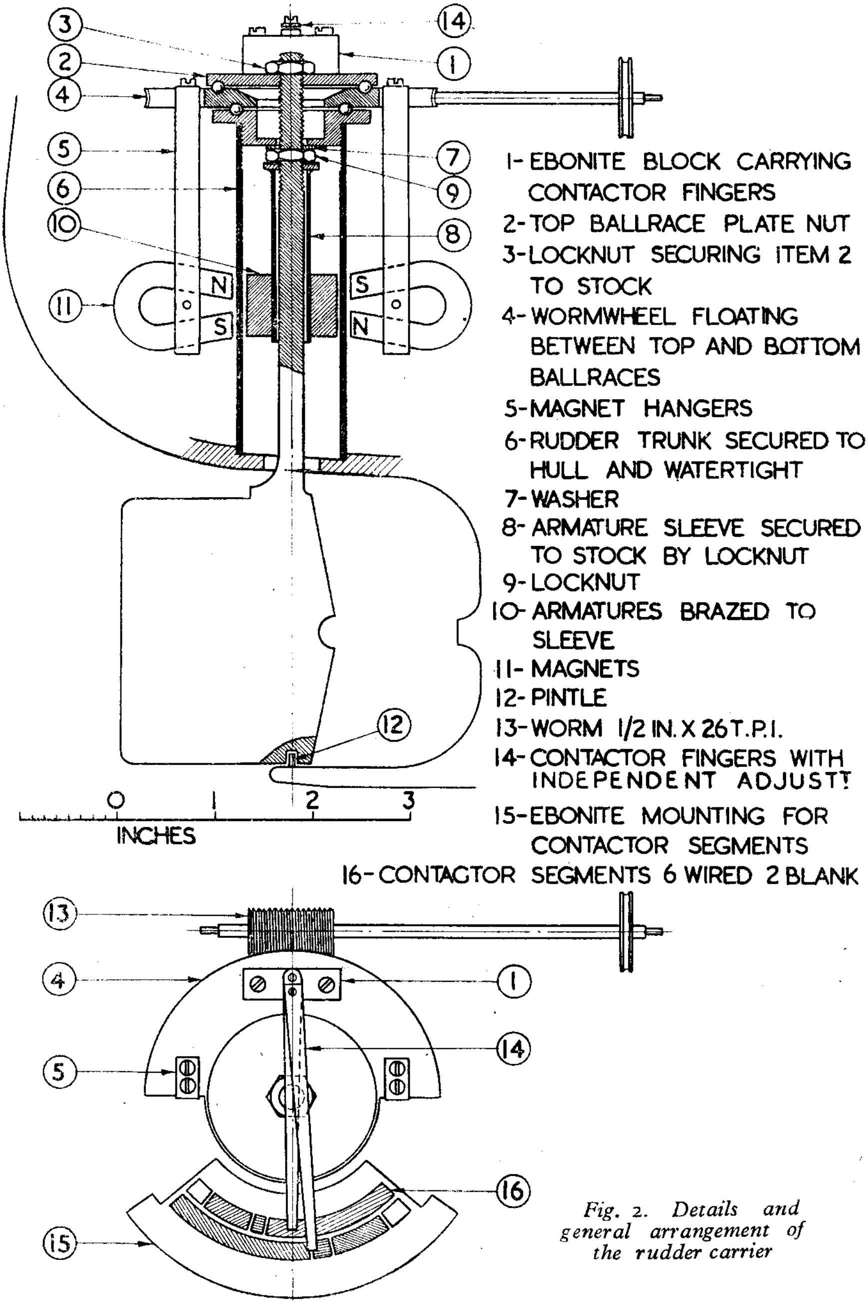


Fig. 2. Details and general arrangement of the rudder carrier

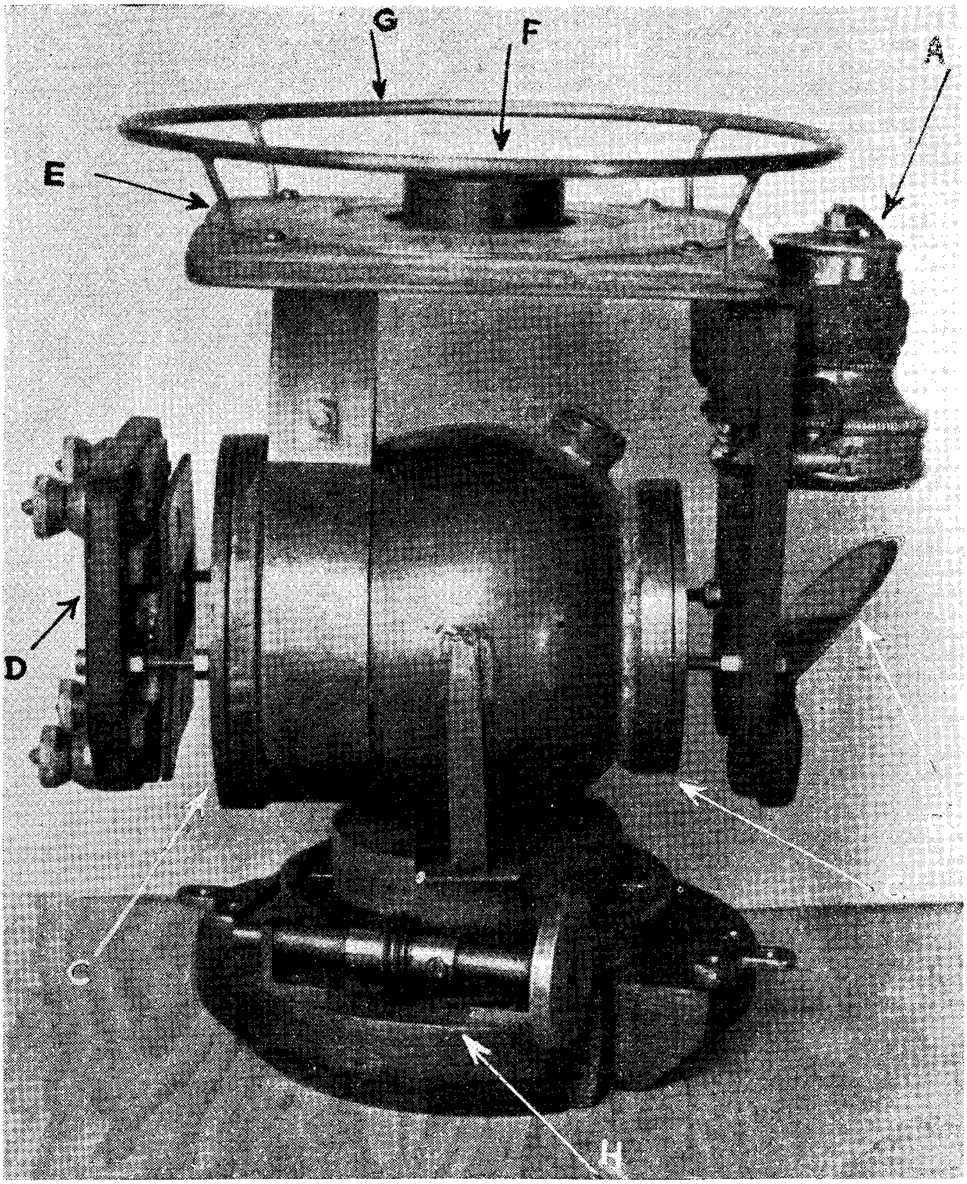


Fig. 3. Compass removed, showing (A) lamp ; (B) mirror ; (C) window mountings ; (D) selenium cell mounting ; (E) compass scale ; (F) axial cable bush ; (G) railing ; (H) worm drive for course changing

then repeat. The choice of orders was a compromise between what was thought to be desirable and what seemed possible. It will be noted that positions 5 and 6 are the only ones where automatic steering is suspended and the tiller grabbed. The selector is shifted from one position to the next by a step-by-step ratchet energised by the armature of the selector-drive magnet. As it is obviously advisable to pass through intervening positions without causing each to function on the way and thus to "jazz the controls," relay (2), which breaks the current flow to two out of the three banks of contacts while the selector is moving, has a delayed release due to the copper slug on the magnet core. Its contacts do not close until the selector has been clear of an impulse for half a second. Consequently, if impulses are transmitted not slower than two a second, relay (2)s contacts remain open until the selector comes to rest. Also, and this is important, two of the three selector wiper contacts are not called on to do any making or breaking and hence are free

from arcing. Why, it may be asked, is not the same arrangement used with the third and right-hand wiper contact? This one, it will be noticed, controls the main propulsion motor while the first two deal with steering and signals. Breaking the current supply to the third wiper during selector moves would stop the propeller every time the selector moved, and this would be most unrealistic as well as a prolific source of interference with the radio receiver.

At the top right-hand side of the diagram will be seen the main propulsion motor with its field coil arranged for reversing by D.P.D.T. contacts of relay (3), whose magnet winding is energised only when the selector comes to rest at position 8.

Going back to the selector contacts in position of "Stop Her," Nos. 1 and 2 wiper contacts light a signal lamp, while No. 3 contact is blank and the main motor gets no juice. On position 1, "Slow Ahead on Course," the main motor is fed through a series resistance. On position 2, "Full Ahead on Course," this resistance is cut out.

On position 3 wipers 1 and 2 give juice to the compass motor, which rotates the compass housing and thus alters the course being steered until cancelled by another order. On position 4 the direction of this motor is reversed and, since it is a permanent-magnet motor, all that is needed is to swop over the supply leads. In positions 5 and 6 automatic steering is suspended by relays 5 and 6, which in conjunction with relay 4 allow the rudder to go hard over instead of keeping within the narrow limits of movement needed when steering a course.

Positions 7, 9 and 10 are duplicates of 0, 1 and 2.

Everything below the dotted line across the diagram concerns steering. Beginning at the left we have the pair of selenium cells SE 1 and 2, whose state of illumination governs the rudder. They are arranged in a Wheatstone bridge circuit with the Weston relay taking the place of the galvanometer. Adjusting the slider of the 20,000 ohm potentiometer when the cells are equally and partially illuminated (vessel on course) results in zero current through the Weston relay, whose tongue is then clear of either contact. If the vessel's head falls away one cell gets more light and the other less, the balance is upset and the relay tongue goes up against one or other contact.

In Fig. 3 note the worm-driven rotatable base, the globular compass body, which has a glass window at each end, the selenium-cell mounting at one end and the lamp at the other. The magnet system carries a screen with a hole in it. The hole is so shaped that according to the position of the magnet system, *one* cell is lit, or adjacent *halves* of *both* cells, or the *other* cell. The corresponding positions of the Weston relay tongue are hard over *one* way, *midships*, or hard over the *other* way.

To go back to Fig. 1, the four telephone-type relays Nos. 5, 6, 7 and 8, are shown in non-energised condition (same applies throughout this picture). On the right is the steering motor and in the middle is a clump of contactor segments with two sinister contactor fingers, 14. Steering motor, rudder and fingers are, in fact, linked together physically by an unholy association of pulleys, rubber bands, a worm drive and some magnetism. This assortment doesn't fit kindly into a theoretical wiring diagram, but Figs. 2 and 3 may help. In brief the steering motor drives the pulley by double-reduction rubber-band belts. The worm on the pulley shaft rotates part 4 carried between upper and nether ballraces. From 4 depend magnet hangers 5, and magnets 11, which cause armatures 10 (locked to rudder stock by armature sleeve 8 and locknut 9) to follow suit on the "Mary and her little lamb" principle. Thus, a flexibly-mounted rudder is operated by a very small motor. But part 4 carries on its top side the two sinister contactor fingers 14, and as the rudder turns these are carried over their respective contactor segments. The fingers are so set that with rudder central (or at whatever setting gives a straight course) each is just inside the edge of the biggest contact of each segment. Now flick back to Fig. 1 and take another glance at the wiring of the segments. Of the three live contacts in each segment the middle one is very narrow and has to do with relay 4, while the two outer ones are permanently connected. Relay 4, when operated, joins the narrow contacts to their neighbours and makes the whole of each segment electrically continuous except for the two blank (unshaded) contacts. These latter act as outer long-stops to limit rudder travel, and when a finger reaches either, the motor stops and can only restart in the opposite direction. But again, relay 4 is only energised when the selector is in positions 5 or 6. At all other times its switches are open and the narrow segment contacts are in fact also dead and hence act as inner long-stops for the fingers, in the same way as the blanks do on full helm. Thus during automatic steering, movement of the contactor fingers (and hence rudder) is limited to a small angle each way from midships and the amount of movement depends on the angular separation of the two fingers. More separation gives less movement and vice versa. As shown in Fig. 1 the rudder is stopped and the vessel's head will be turning slowly to port. When the yaw is sufficient the steering motor will be started up in the opposite direction and the two fingers will move together some 3 deg. downwards until the longer finger passes on to the narrow dead contact, acting as an inner long-stop.

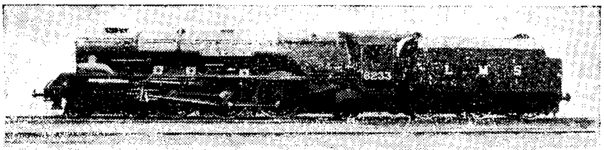
To sum up the story of a single rudder movement: the vessel's head begins to yaw, the compass housing begins to turn with the ship (the compass needle staying put), one selenium cell begins to walk out of the limelight and the other to walk in, the bridge balance begins to be upset, the Weston tongue begins to move and, making contact, operates relay 7 (or 8), the steering motor begins to run, the rubber bands, the worm-wheel and the magnets, 11, do their stuff and the rudder begins to move; so also do the villains of the piece, the contactor fingers, but they never run off the end because the long-stops always catch them and the story has to start again.

Such is the theory of the job and I confess that it seems a terribly long way round to achieve a fairly simple object. If anyone can see any simplification I would be very glad to have details. Before leaving theory I might point out that the two contactor fingers with adjustable separation seem to provide very accurate control of a small servo motor which is a problem that has cropped up in these pages before.

(To be continued)

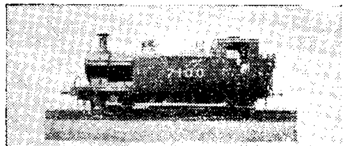
Standard L.M.S.R. Locomotives

Reproduced to the Same Scale



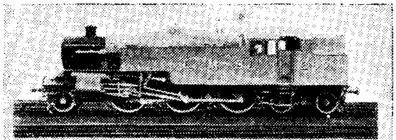
4-6-2 (NON-STREAMLINED) 4 CYL. PASSENGER.

TOTAL WEIGHT 161–12 (T. C.) 6′–9″ WHEELS.
TRACTIVE EFFORT 40,000 LBS. CLASS 7.



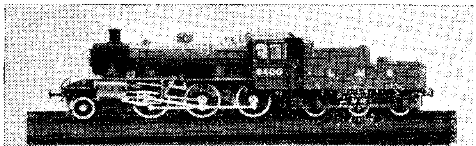
0-6-0 2 CYL. FREIGHT.

TOTAL WT. 49–10 (T. C.) 4′–7″ WHEELS.
T. E. 20,830 LBS. CLASS 3.



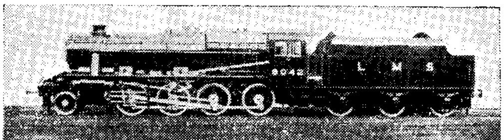
2-6-4 2 CYL. MIXED TRAFFIC.

TOTAL WT. 85–5 (T. C.) 5′–9″ WHEELS.
TRACTIVE EFFORT 24,670 LBS. CLASS 4.



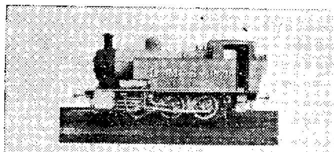
2-6-0 2 CYL. FREIGHT.

TOTAL WEIGHT 82–10 (T. C.) 5′–0″ WHEELS.
TRACTIVE EFFORT 17,400 LBS. CLASS 2.



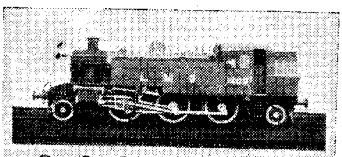
2-8-0 2 CYL. FREIGHT.

TOTAL WEIGHT 125–15 (T. C.) 4′–8½″ WHEELS.
TRACTIVE EFFORT 32,438 LBS. CLASS 8.



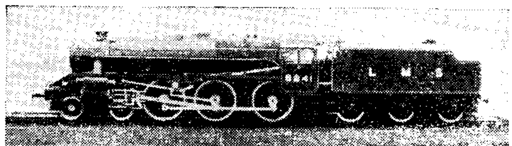
0-6-0 2 CYL. FREIGHT.

TOTAL WT. 43–12 (T. C.) 3′–11″ WHEELS.
T. E. 18,400 LBS. CLASS 2.



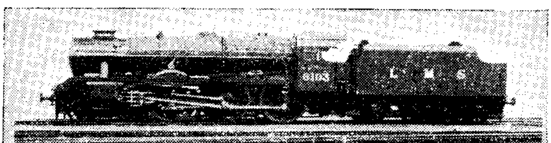
2-6-2 2 CYL. M. T.

TOTAL WT. 63–0 (T. C.) 5′–0″ WHEELS.
T. E. 17,400 LBS. CLASS 2.



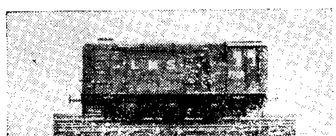
4-6-0 2 CYL. MIXED TRAFFIC.

TOTAL WEIGHT 125–15 (T. C.) 6′–0″ WHEELS.
TRACTIVE EFFORT 25,455 LBS. CLASS 5.



4-6-0 (ROYAL SCOT) 3 CYL. PASSENGER.

TOTAL WEIGHT 137–13 (T. C.) 6′–9″ WHEELS.
TRACTIVE EFFORT 33,150 LBS. CLASS 6.



0-6-0 DIESEL SHUNTING.

TOTAL WT. 47–5 (T. C.) 4′–0½″ WHEELS.
TRACTIVE EFFORT 35,000 LBS.

A 2-in. Scale Traction Engine

By

D. E. Clapham

FROM a few rough sizes of engines on the local fairground, I prepared drawings and spent a great deal of time before I was satisfied I had a good working job. The overall sizes are: length, 3 ft. 3 in.; height, 1 ft. 10½ in.; width, 1 ft. 3½ in.; weight, 168 lb.

The engine is a compound, H.P. 1⅛ in., L.P. 1⅝ in. bore, by 2 in. stroke. The cylinders are cast-iron, with ports and steam passages drilled and chipped out as required. The H.P. cylinder has a steam cavity round it to prevent condensation. Valves are of brass, with a buckle and 5/32-in. rustless steel rods. The valve-motion is Stephenson's, and, to enable the engine to start, a simpling valve is provided in the chest on the tops of cylinders to admit steam to L.P. cylinder when the H.P. is on dead-centre. A push rod lifts a ball off its seat and allows steam to pass to the L.P. cylinder. The cranks being at 90 degrees gives the engine a start. The crankshaft was turned from a piece of steel shaft 2¼ in. diameter.

Eccentrics are cast in pairs, with sheaves and straps of cast-iron, and lubrication of the cranks is by means of two banjo discs fixed in between the cranks, fed by two small pipes from an oil-box over boiler front. One disc is grooved to drive the governors for stationary work for dynamo driving.

Crossheads run in trunk guides.

Cylinders are cast together in iron and fixed to boiler with a bronze saddle casting, with a broad flange for 5/32-in. bolts. The top end of casting has a flange on which the cylinders are fixed by 5/32-in. set-screws underneath. The outer end of guides is supported from a pad on the boiler.

Bearings to take the thrust of the links are bolted to the guides. A small slide-valve is used for starting the engine, and gives very slow running in a tight corner. A pop valve is set at 100 lb. to the square inch.

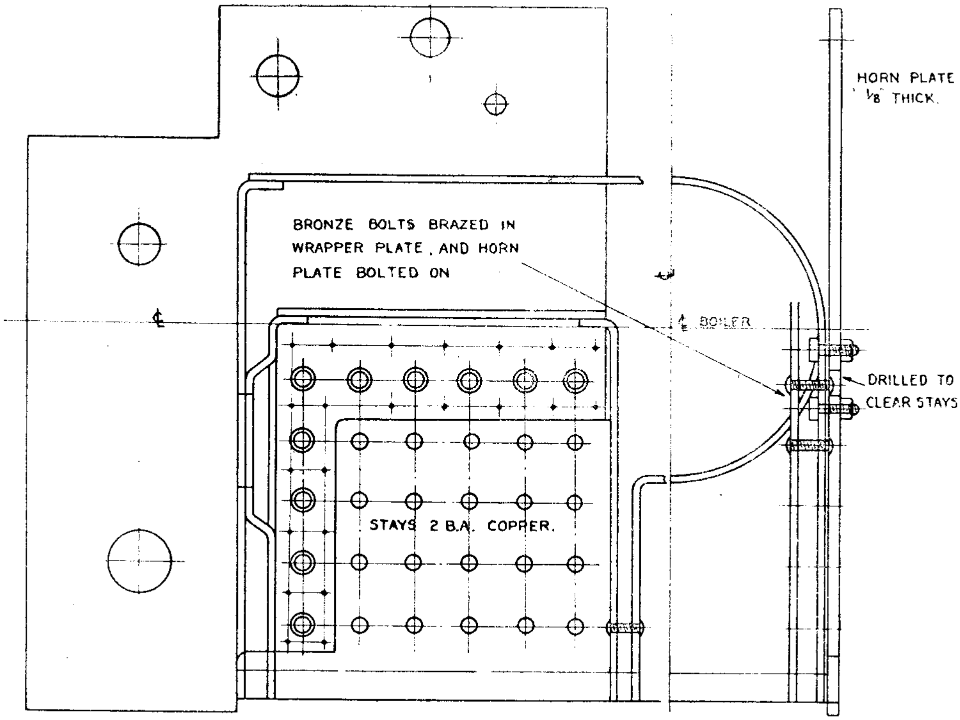
The boiler is 5 in. diameter solid drawn 12-gauge copper, 11 tubes $\frac{9}{16}$ in. outside, 20-gauge and one ¾-in. tube for superheater; tube-plates are ⅛ in. thick. The rest are 12-gauge and all put together with $\frac{3}{16}$-in. cup-headed rivets. Seams were sifbronzed on the outside edges afterwards. Two girder stays of 14-gauge are used to support the firebox top, and No. 2-B.A. stays are used every inch for the firebox sides. The tubes are screwed into the firebox; then expanded and turned over $\frac{1}{16}$ in. at smokebox end.

Two speeds are provided. The low gear is 21.5-to-1, and the high 11-to-1. The first pair of gears in each case are $\frac{7}{16}$ in. wide; the others are $\frac{9}{16}$ in., excepting the last drive, which is $\frac{11}{16}$ in. wide. These gears were cut locally from the steel blanks turned by myself and are 16 D.P. The large wheel on road-shaft is cast-iron and is cut 14 D.P., with its driver the same. The compensation gears were cast from patterns taken from gears which were loaned to me.

The engine is carried on front and rear springs. The back axle is 1 in. in bearings and is connected to the third intermediate shaft by links which keep them both in mesh.

The road wheels are constructed as near as possible to the larger ones; that is, outer rim, with tyre fixed on, two T-iron rings to each, and 14-gauge spokes cut from one solid disc. The front wheels are made in the same manner. Axles are screwed on the end, and a nut with split-pin keeps the wheels in position. Chromium-plated hub-caps give a finished appearance.

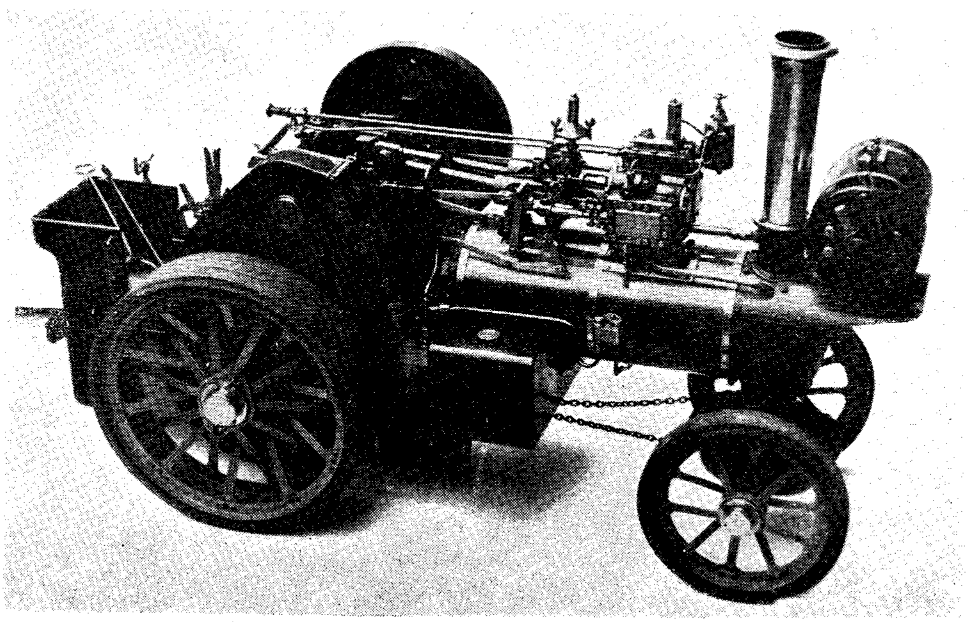
Two pumps cater for the water supply—a hand pump in the tender and a geared pump run by the crankshaft (geared down 2-to-1, being ⅜ in.



Method of fixing horn plates to firebox

bore and ½ in. stroke). A handwheel in tender operates the water by-pass. A double clack-valve is fastened on the side of boiler and connected to each pump.

The engine, in low gear on a slight incline, pulled a trailer on which were four adults who weighed altogether 6 cwt., the combined weight of engine, trailer and load being nearly 8 cwt.



A MODEL "SENTINEL"

An interesting sequel to a description published in "The Model Engineer," September 12th, 1946

Photo by courtesy of The Gas Light and Coke Co.

MANY of our readers will remember the illustrated description of a 1-in. scale "Sentinel" steam wagon made by Mr. F. E. Patten, Mechanical Transport Foreman of The Gas Light and Coke Company. Through the kindness of Mr. R. Evans, of the company's Public Relations Department, we are able to publish the story of an interesting sequel. Early in January, the company received the following letter dated January 2nd, from Norwood, South Australia; it was addressed simply to The Gas Light and Coke Co., London, Mech. Transport Foreman, Mr. F. E. Patten :—

"Dear Sir,

"I make a strange request of you but would be very grateful if you could oblige.

"Just a few weeks ago I read an article of your model and studied the photographs of the 'Sentinel' Steam Wagon, as published in THE MODEL ENGINEER.

"I am particularly interested in the steam wagon, but unfortunately we in Australia do not have the privilege of seeing these fine examples of steam engineering. Over the last few years I have commenced gathering together a collection of photographs of all types of vehicles used in transport. Amongst them I have a post card of the old overtype (Foden), and I would like to add the '*Sentinel Wagon*,' the latest streamlined type.

"I understand these vehicles have a 2-cyl. comp. H.S. engine and gear box, and speeds approximating 45 m.p.h.

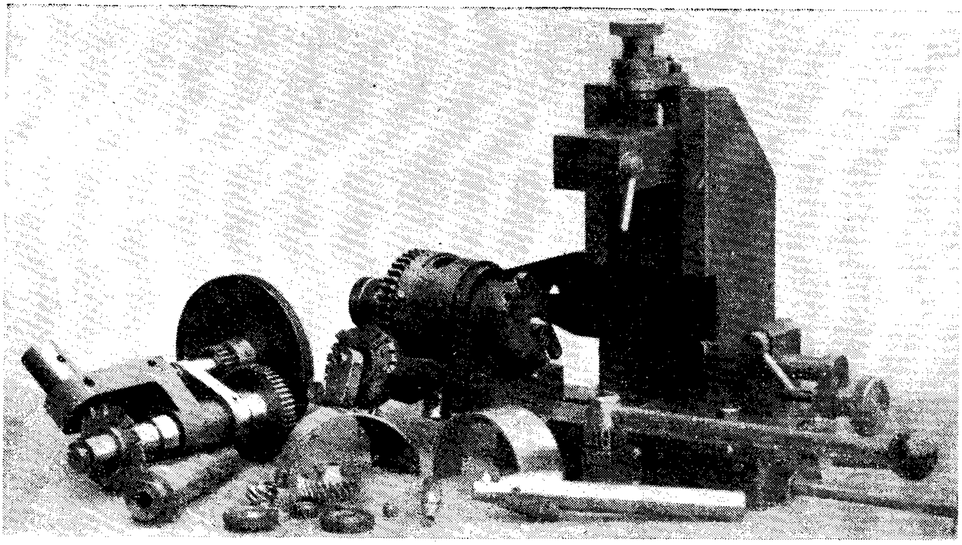
"Could you possibly secure for me a photograph of this vehicle. I am prepared to mail your postal costs, etc., by return mail.

"I await your reply in anticipation.

"Yours respectfully,
MALCOLM J. HAMILTON."

Curiously enough, Mr. Patten lives within a stone's-throw of Norwood, London, and the request is from Norwood, Australia! Needless to say, suitable photographs and information have been sent to the enquirer.

Mr. Patten's model was on show at the MODEL ENGINEER Exhibition, last August, and was again exhibited to the public at the recent Schoolboys' Exhibition. In the photograph reproduced, Mr. Patten is seen explaining the model to interested schoolboys. He spends most of his spare time in building mechanical miniatures; his latest effort is an 8,500-r.p.m. steam engine which started life as an idea, two Messerschmidt ball-races and a little scrap metal.



The machine with various spindles, cams and some of the work done by it

*A GEAR-CUTTING MACHINE

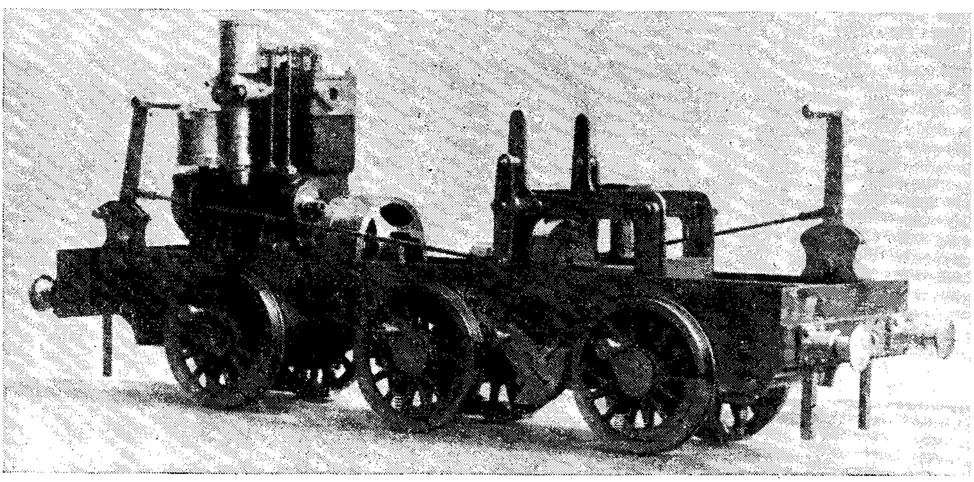
By J. S. ELEY

GEAR cutters are always a problem to the impecunious home mechanic. As if their individual cost was not high enough, no less than eight of them are required to cover the whole range of teeth in each pitch. I can offer no complete solution except to show how the problem has been tackled in my own case. At the time the machine was made, I could obtain the loan of a range of cutters, but knowing this would not always be so, a method was devised of making copies as follows :—

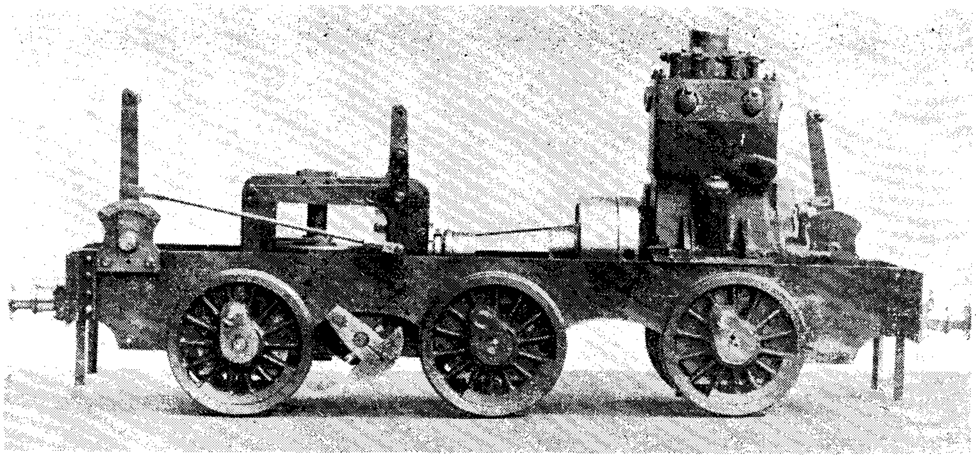
(1) Make a form tool by passing a standard gear cutter across the end of a bar of tool steel. This should be done at a slight angle to provide front clearance. The tool is then hardened.

(2) Turn up the cutter blank from silver steel.

**Continued from page* 246, "*M.E.,*" *Feb.* 13, 1947



The carburettor size of an " 1831 " *chassis*



The sparking-plug side of an "1831" chassis

This is in the form of a Woodruff cutter, but with the shank eccentric to the disc.

(3) Chuck the cutter blank by the shank in the four-jaw and set so that the cutter disc runs truly.

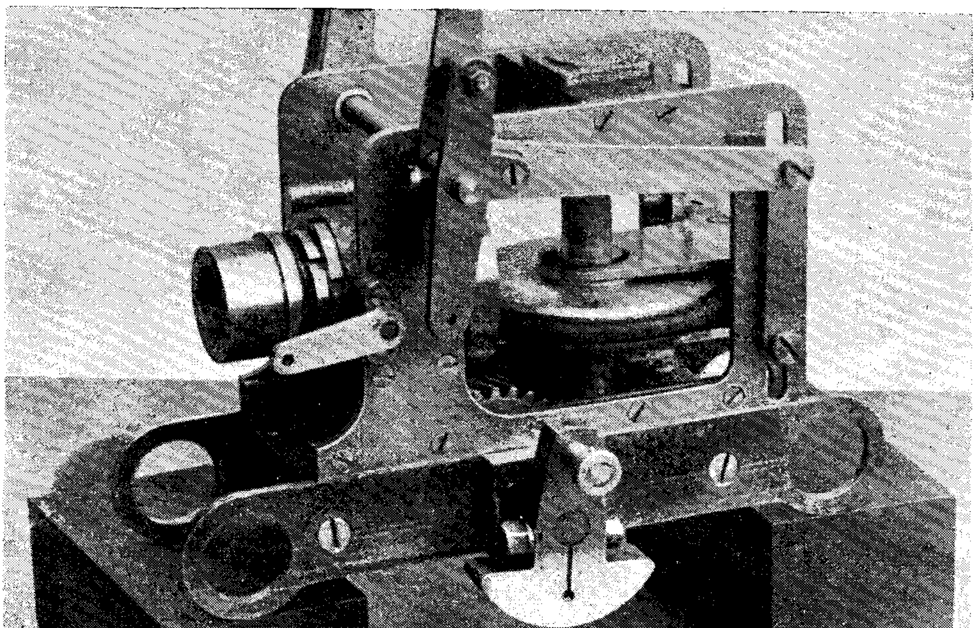
(4) Rough the disc to shape and finish by means of the form tool already prepared.

(5) Mark the point on the circumference of the disc furthest away from the shank, and from this point, file or grind away the edge of the disc for half the circumference.

(6) Harden and temper. This gives a single-tooth gear cutter, properly backed off, which can be sharpened innumerable times, and yet retains its tooth form to the end of its life.

The diameter of the cutter should be kept on the small side, $\frac{3}{4}$ in. to 1 in. is sufficient, as they can then be used for cutting small gears with steep spiral angles. Standard gear cutters are no use for this job, as owng to their large diameter and the sharp curve of the gear tooth, they foul both fore and aft. In order to accommodate this type of cutter, another spindle was made for the machine, incorporating a simple chuck. This has a reamed $\frac{1}{2}$-in. hole, the cutter shanks being $\frac{1}{2}$ in., and secured by four small Allen screws. One of the photographs shows this chuck holding a cutter bar with an inserted tooth of ground high-

(*Continued on page* 278)



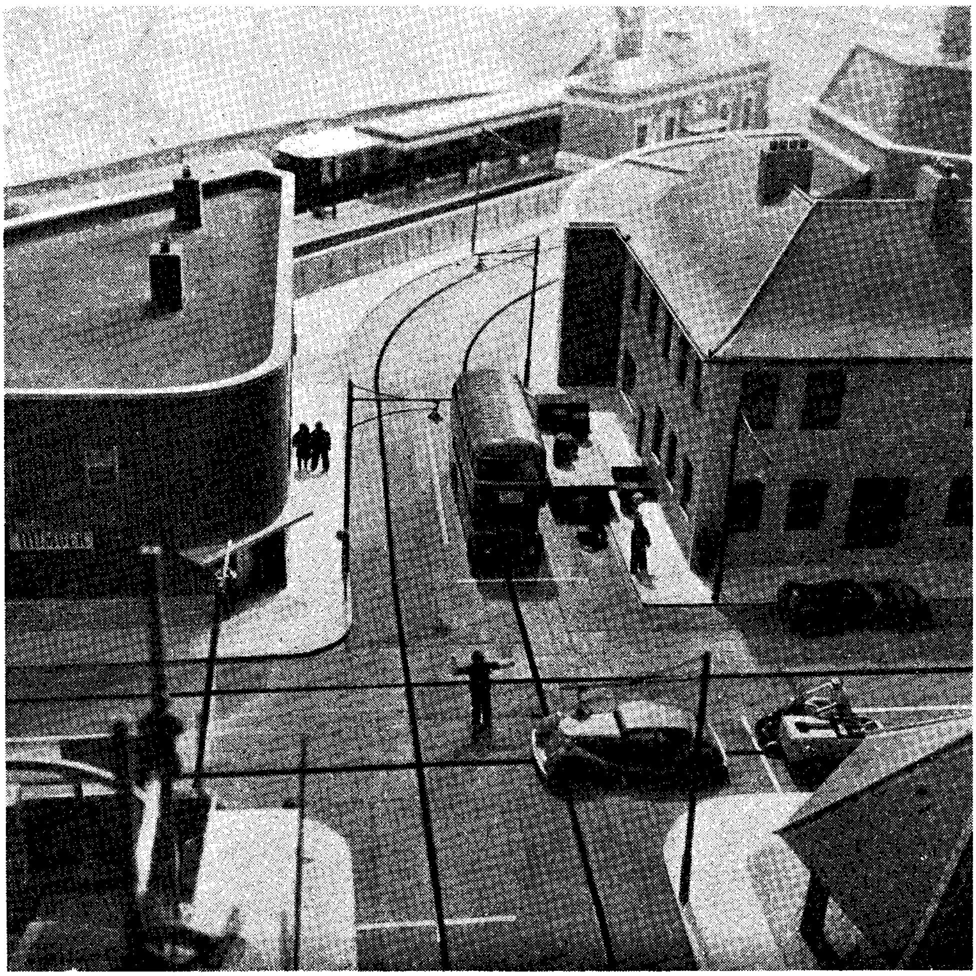
An "1831" gearbox, incorporating spiral gears produced on the gear-cutting machine

"SAFETY FIRST"

on Model Roadways

MODEL engineering, in its many and varied branches, provides an outlet, not only for the creative urge, inventive talent and craftsmanship of its exponents, but also for diverse shades of interest in the operation, working or display of the models. Those who admire ships may revel in the piloting of a model sailing yacht or a graceful "prototype" power boat; while the lure of speed is catered for in the model hydroplane or racing car, and the thrill of the air is captured by model aircraft. The man whose youthful ambition to drive an express train was frustrated by the exigencies of existence may find solace in the construction and operation of a model passenger-hauling steam locomotive. Model electric railways appeal to those whose main interest is in the railway as a complete entity, and who find scope for both design and craftsmanship in signalling systems, track work and rolling stock.

Up to the present, it does not seem to have occurred to many model engineers that there is equal scope for ingenuity and interest in the development of model roadways and road vehicles, and the control of traffic in this sphere. Road models, such as have been made, are usually



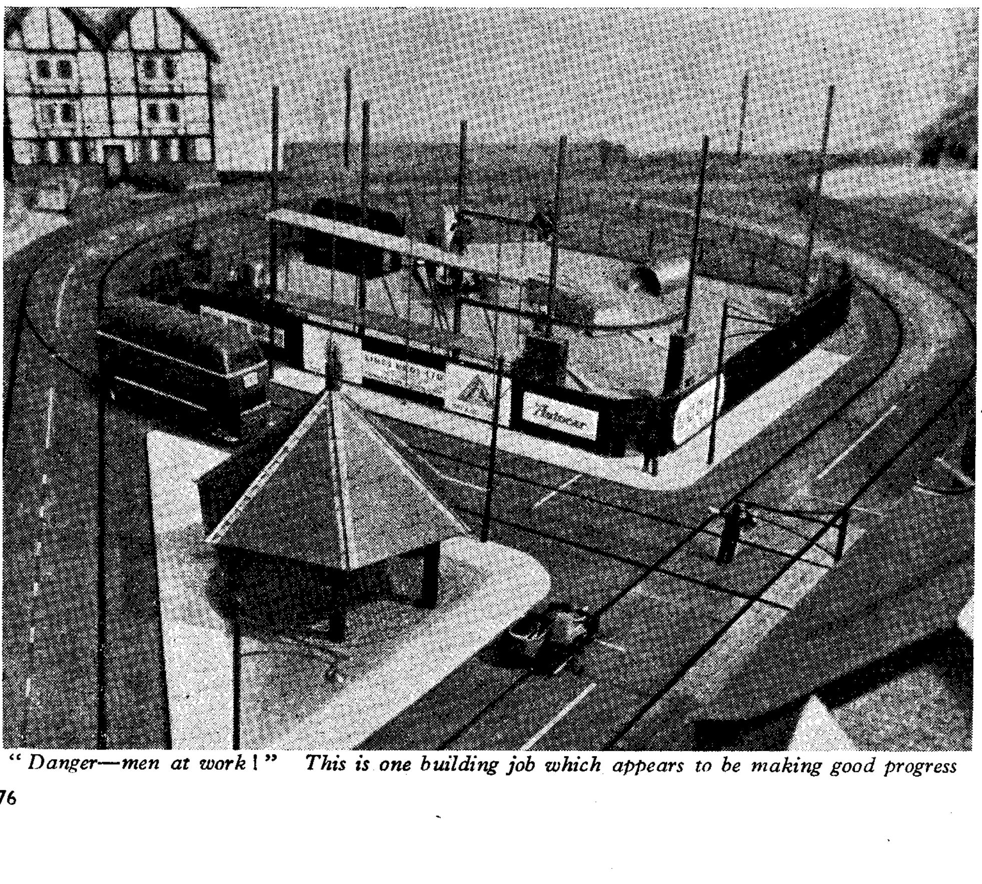
P.C. Robert Robot directs the traffic at Station Road crossing

static, and related rather to the architectural class of models than the Lilliputian world of motion which fascinates most model engineers. Yet the modern prototype highway is full of action—perhaps a little too full to suit some of us!—and presents far more complex traffic control problems than the railway, in which the movements of traffic are mainly systematised, and the operation of controls or signals produces an instantly apparent or predictable effect. It will be realised that a model of a busy road system, with a profuse stream of widely varied types of vehicles in constant motion upon it, offers great possibilities for ingenuity in devising and construction, not to mention the interest which can be obtained from its operation. Moreover, such a system can be put to highly practical use, in helping to solve modern traffic problems, in teaching road sense, and even in illustrating points of evidence, or settling points at issue in legal disputes.

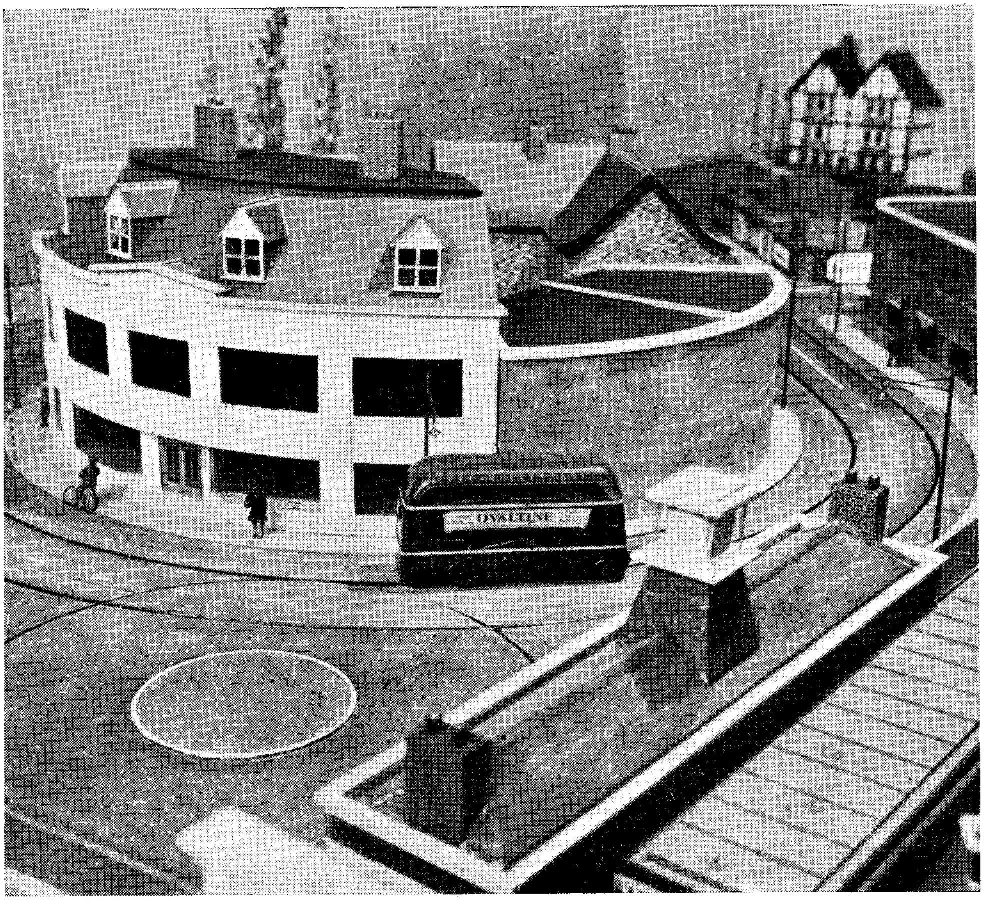
This eulogy of the type of model under discussion does not in any way imply an odious comparison with other types of models; it is obvious that a model roadway can be used to supplement and augment the interest of a model railway or architectural layout, with a broadening of interest and general improvement in spectacular effect.

A very remarkable model of a complex road system, with working vehicles and traffic control, has been constructed by a group of model engineers in Cambridge, whose ingenuity and enterprise have been devoted to this project for some considerable time. The model, which has been developed by gradual stages, has now grown to a size which completely fills a fair-sized room (with a grudging allowance of just sufficient space to squeeze in a couple of mere human beings!) and is still swelling visibly. It incorporates both urban and rural settings, with main streets, byways, country roads, crossings, roundabouts, gradients, and level crossings—a model railway, incidentally, being also incorporated in the scheme of things. The vehicles on the roads include private cars, commercial vans, lorries and tankers, cyclists and motor-cyclists, not to mention a few pedestrians, though the latter do not—up to the present, at any rate—appear to be "mechanised." Horse-drawn traffic is absent, as befits up-to-date traffic conditions, which are but little suited to this willing but almost obsolete animal.

The vehicles are electrically-driven, the motors being of the same type as those used in miniature model locomotives, and they are fed with current from conductor rails submerged below the road surface, a slot being provided in the latter to take the collector shoes attached to the vehicle. These are built into a guide unit, which is connected with the steering gear of the vehicle in such a way as to impose the minimum restraint or brute force on the natural motion when negotiating curves. As the entire gear is below the vehicle, it is practically invisible, and does not mar the realism



"Danger—men at work!" This is one building job which appears to be making good progress



The shopping centre—on early closing day !

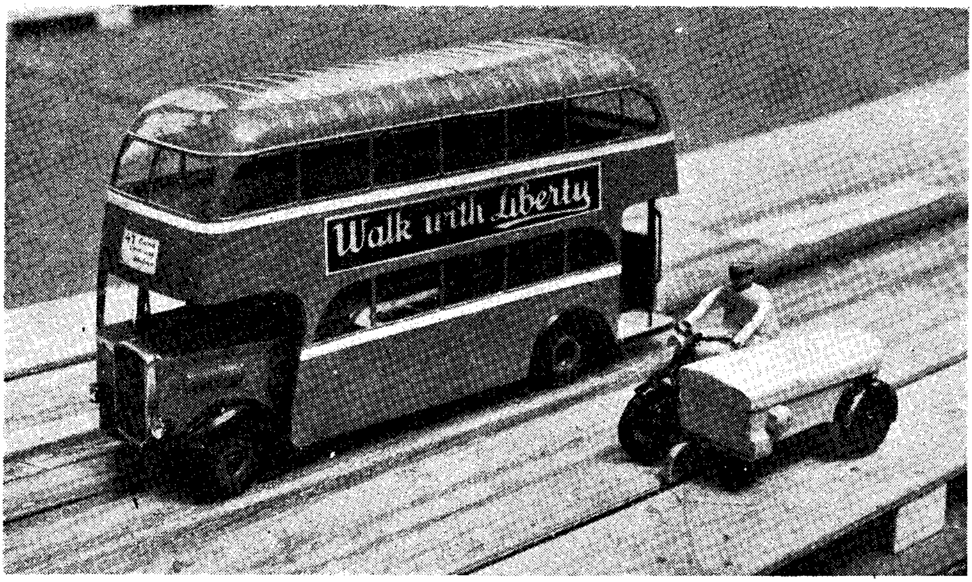
of appearance, the slot in the roadway also being as narrow and unobtrusive as possible.

Most of the vehicles are home-made, though a few have been adapted and "motorised" from commercially-produced toy cars; in all cases, true scale has been carefully observed, and meticulous detail work put in to produce a realistic appearance, as will be evident from the photographs.

Control of the models is semi-automatic; that is to say, the operator or operators can start, regulate, stop or direct each vehicle from a main control panel, but traffic control at road intersections, or when overtaking, is automatic. At the main crossing in the town, a policeman is on duty to direct the traffic; it would have been just as simple to fit light signals at this point, but rather less interesting. To disclose behind-the-scenes secrets, it may be mentioned that our traffic policeman is attached to the centre of an electrically-operated rotary switch below the road surface, and thus turns when the switch changes the right-of-way. Precedence is given to main road traffic, and any vehicle which approaches a crossing in the direction closed to traffic at the time is automatically switched off and brought to a standstill until the way is clear. Similarly, any vehicle which attempts to overtake another on a branch crossing or roundabout is stopped. In fact, the road sense and courtesy of these robot drivers would provide an object lesson to many of the (more or less) human drivers on our roads at the present day !

A great deal of ingenuity is also displayed in the architectural and scenic portions of the layout, which are a refreshing change from the stereotyped furnishings so often seen in scenic models, without being obtrusively daring or futuristic in conception. Note how the architect has not been content with the prim and formal styles of buildings, but has introduced variety in both their form and arrangement. In one place, a distinctly up-to-date flavour is introduced by a block of buildings under construction.

The planners of this novel system have also applied the same principle of dirigibility to miniature model racing car tracks, in which the same type of motor and conductor-shoe-cum-steering gear is employed. By this means it is



"Wot—no bus queue?" asks the overtaking A.A. Scout

possible to make cars traverse a complex route, and to allow for cars passing or overtaking each other; also, in the case of cars running abreast on a circular or oval course, each car in turn may be made to take the outside track, so that each would traverse the same total distance over a number of laps. The possibility that one car may have to wait while another takes precedence at a crossing, introduces a chance hazard, which should enhance interest in the race. A number of operators, each driving his own model car by means of a controller at the main switchboard, may thus be enabled to participate in a gruelling and exciting race, in which all the thrills of the full-sized speedway, including skids, spills and crashes, may be featured, but where there is no cause to fear risk to life or limb, nor to keep the fire engine and ambulance in attendance.

A Gear-Cutting Machine

(Continued from page 274)

speed steel. This was ground to shape by hand, using a form tool as already described as a template. Unfortunately, this type of cutter has not a long life, as it cannot be resharpened without destroying the tooth form. It lasted long enough, however, to cut the steel gear for the "1831" transmission. The method of centring it is also shown. Incidentally, single-tooth fly-cutters are used quite frequently in the commercial production of some types of gears.

Conclusion

The description of this machine has been put before readers in the hope that some of the ideas embodied in it may prove useful, even if the machine as a whole is not of interest, as the individual components have useful applications on their own. For instance, anyone having a milling machine, and wishing to make use of this method of generating spirals need only make up the base table, dividing head, and back centre. This assembly would then be bolted to the milling machine table at an angle corresponding to that of the gear to be cut, and procedure followed as already described. The machine can also be used for the end-milling of keyways and spline shafts, and special items such as cinematograph sprockets. One of the photographs shows the swinging arm replaced by an end-milling spindle in its own bearing. This was actually made up to try gear cutting by end milling, but this method was not a success, as the cutters were difficult to make in small sizes, and were also too fragile. By the way, the photographs were all taken by myself with a 35 mm. camera, and were the cause of a sharp rise in temperature in the dark room, when on development it was found that the first series to be taken were all super-imposed on one another, giving a Picasso-esque effect. In conclusion, I shall be only too pleased to give any further information that may be required, as well as to receive any suggestions. Many other adaptations and improvements come to mind, and the next attachment to be made is—but there, I'm in the same old rut again. Some day, who knows, I might even finish a model.

PETROL ENGINE TOPICS

* A 15-c.c. FOUR-CYLINDER ENGINE

By Edgar T. Westbury

A VERY important factor in the success of an engine of this type is the quality of the castings used in its construction, the accuracy and detail of which need to be of a high order. Both the pattern-making and moulding on these castings have called for great skill; and in the former work, I have been extremely fortunate in obtaining the co-operation of Mr. H. C. W. Frost, who is known to many readers of THE MODEL ENGINEER for his craftsmanship in making small and intricate patterns, some of which have formed the basis of notable exhibition models. The castings have also been produced by a craftsman of no mean ability, and I hope to be able to make an announcement that they will be available to readers in the near future.

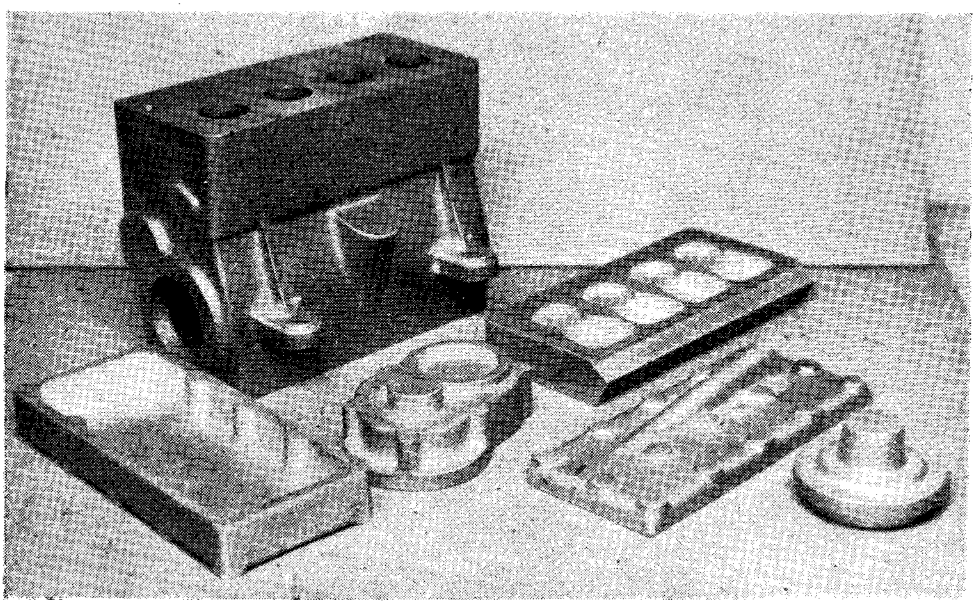
Construction

All the castings of the engine have been designed so that they can be machined by the equipment and methods available to the average model engineer; the largest casting will swing comfortably in a 3½-in. lathe, and even with smaller lathes, alternative methods can be devised for handling the essential machining operations. Much of the work on the castings can be done by mounting on a faceplate or angle plate, and odd-angle machining operations have been avoided wherever possible—in fact, they are only introduced in components or surfaces which are not essential to mechanical accuracy, so that small angular errors in these operations do not affect the working of the engine. The small screws and bolts used in the engine are mostly in B.A. sizes, as these are generally the most readily available, and offer the widest choice of sizes; but there is no objection to the use of the nearest Whitworth sizes, and these offer advantages for threads which are tapped in the light alloy castings. Positions of clearing holes are shown on the drawings, but as the tapping holes, in practically all cases, can be produced by "following through" from these holes, there is no necessity to show these in detail.

Part No. 1.—Main Cylinder and Crankcase Block

This is the largest single component, consisting of a cored casting incorporating seatings for the "wet" cylinder liners, housings for the main bearing end-plates, and surfaces for the attach-attachment of the cylinder head block and sump. It will be noted from Fig. 2 that all the main machined surfaces are at right angles to each other, so that setting-up is simplified, and various alternative machining methods can be employed. The casting should first be set on a surface plate

*Continued from page 201, "M.E.," February 6, 1947.



Main structural castings of the "Seal" 15-c.c. engine

and checked up as to general dimensions ; it is not necessary to attempt complete marking-off, so long as it is ascertained that all essential surfaces will machine up in their correct location and relation, and any possible small errors of dimensions, such as may be caused by slight displacement of cores or misalignment of moulding boxes, are "halved out." Do not forget the invariable rule to take location from surfaces which will not be machined, as the amount of allowance left on machined surfaces may vary slightly, or may be affected in the fettling process.

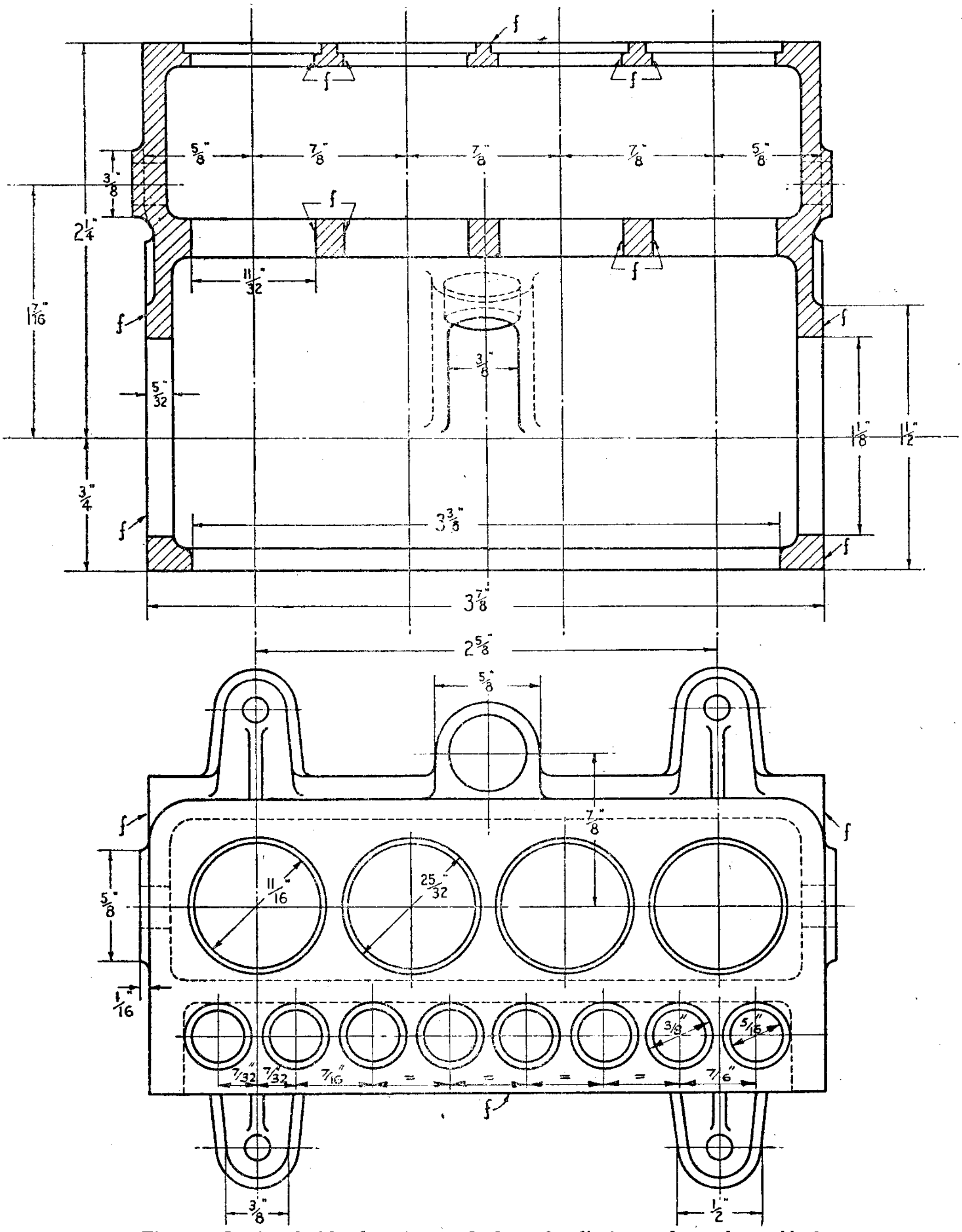


Fig. 2. Sectional side elevation and plan of cylinder and crankcase block

The machined surfaces on this casting are indicated by the customary mark (*f*). Do not, at this stage, plug the cylinder seating bores for marking the centres, as it is more convenient to do this at a later stage.

The general checking-up of casting dimensions is one of the first things any constructor should do, as it brings to light any possible errors or discrepancies either in the drawings or castings, and gives one an opportunity to invoke the aid of "the gentle art of compromise" in putting them right if it should be necessary. If this rule were universally observed, we should encounter much fewer complaints about castings which won't clean up, or structures which machine up too thin for proper strength. Even in the best regulated designs, and the most carefully made castings, errors are sometimes inevitable, and the common policy of "leaving plenty of metal" on machining surfaces is quite a fallacious one, since it encourages slipshod setting-up, and consequent risk of false relation between machined and unmachined surfaces.

Although there are several quite practical methods of procedure in machining this casting, the recommended method is first to machine off the top and bottom surfaces, and use one or other of these as a reference surface for subsequent operations. The casting may be held in the four-jaw chuck, by the head end, for facing the bottom surface, setting up so that general squareness, by reference to the preliminary check-up, is preserved, and machining to a distance of ¾ in. to the shaft centre line. This dimension is not a critical one—the really essential thing is that the surface should be parallel to the shaft axis, and square with the cylinder bores—but getting it right in the first place will simplify subsequent setting up for other operations. Leave the machined surface as clean and smooth as possible, as it is required to make an oil-tight joint eventually.

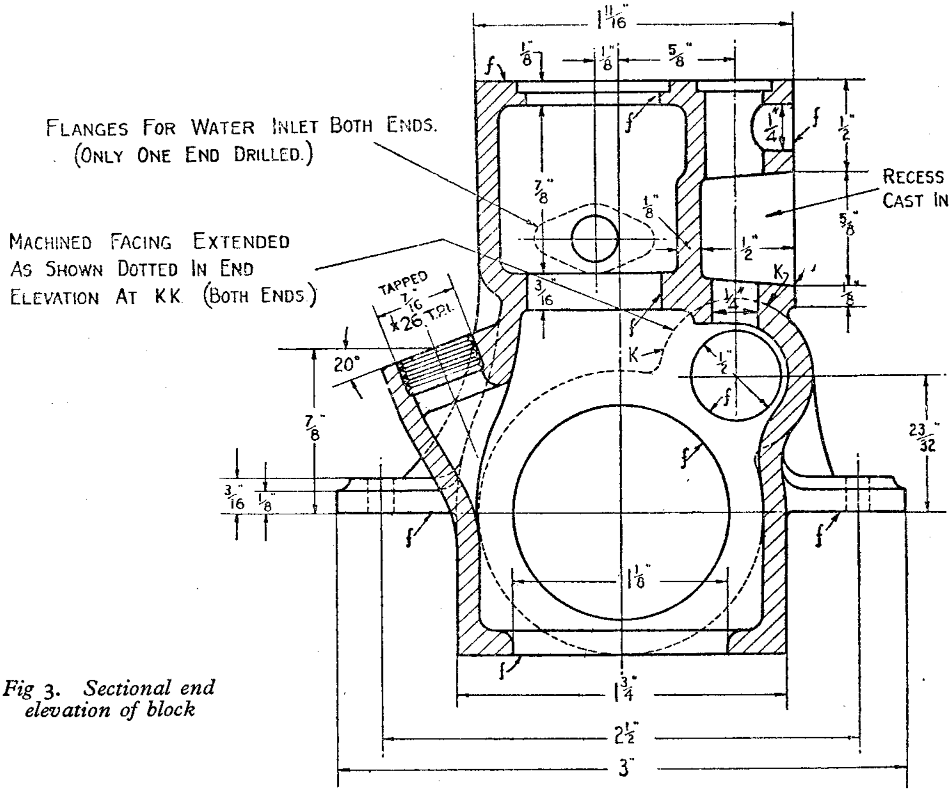


Fig 3. Sectional end elevation of block

For machining the head, it is best to bolt the base to the lathe faceplate, because assuming that the latter runs truly, the parallelism of the top and bottom surfaces will then be beyond dispute. A simple way to hold the casting is to pass a flat bar right through the end-plate housings, with a couple of bolts as near as possible to the ends of the casting, so that they are easy of access and provide maximum security. Incidentally, I have often been criticised for the use of any odd bits of junk for use in bolting work for machining—not at all like the neat straps and clamps so often seen in the text-book illustrations. Well, I am all for using the proper fittings for the job whenever they are available; and if a great deal of use is made of any kind of fitting, it is worth while to spend any amount of pains to make it not only neat and workmanlike, but also thoroughly well adapted to its job. But the requirements of machining problems in the

amateur workshops are so many and varied that one would require a complete arsenal of special fittings to cope with all eventualities. One should not place an undue importance on the fittings themselves—they are purely and simple a means to an end, and may possibly only have to be used once, or at most, very rarely. For this reason, the use of "rag-time" clamping devices is fully justified, providing that they serve their purpose with reasonable efficiency, and do not involve any loss of quality in the work produced.

The truth and smoothness of the finished top surface is of even greater importance than that of the bottom, but it may be found a sound policy not to machine it right off to finished dimensions—$2\frac{1}{4}$ in. from the centre line of shaft or 3 in. from the base surface—but to allow for a finishing cut after the liners are inserted.

Next, the ends of the casting should be faced, and the end-plate housings bored. If a fair-sized angle plate can be swung on the lathe faceplate, the casting may be set on this, securing it by clamps or straps over the feet of the bearers. Check the general squareness of the casting by means of a try-square on each side, then shift the angle plate to centre the housings—do not rely on the cored holes for setting up, but work from essential dimensions, and if any doubt exists as to the correct centre line, plug the bore at one end with a piece of hardwood or metal, and set out the centre on it.

If it is found difficult or impracticable to swing the casting in the lathe, it may be clamped to the cross-slide, packed up to centre height, and bored with a boring bar. This method has some definite advantages, especially in positive location of the centre line; if the exact height of the lathe centres, over the cross-slide, is known or ascertained, the required thickness of packing can also be found, and parallel blocks or strips built up to this thickness. Use the try-square against the lathe faceplate to check the squareness of the casting, and secure it by clamps over the bearers as previously suggested.

The housings are bored to $1\frac{1}{8}$ in. diameter, and if it is found difficult to adjust the boring bar to finish exactly to size, it may be noted that this, again, is not a critical dimension, as the external diameter of the bearing housings can be adjusted to fit. Facing the end surfaces is best carried out by swinging the castings on a mandrel, for although it is practicable to do this by means of right- and left-hand facing cutters in the boring bar, the result often leaves much to be desired. The use of a point facing-tool, in conjunction with traversing movement of the work on the cross-slide, is practicable, if one is quite certain that the cross-slide moves *exactly* at right angles to the lathe centres—which is by no means to be taken for granted in all cases.

At the same setting as the facing of the ends, a cut can be taken over the flanges on the upper part of the casting. These stand $\frac{1}{16}$ in. proud of the end face, but this measurement is not important.

Camshaft Tunnel

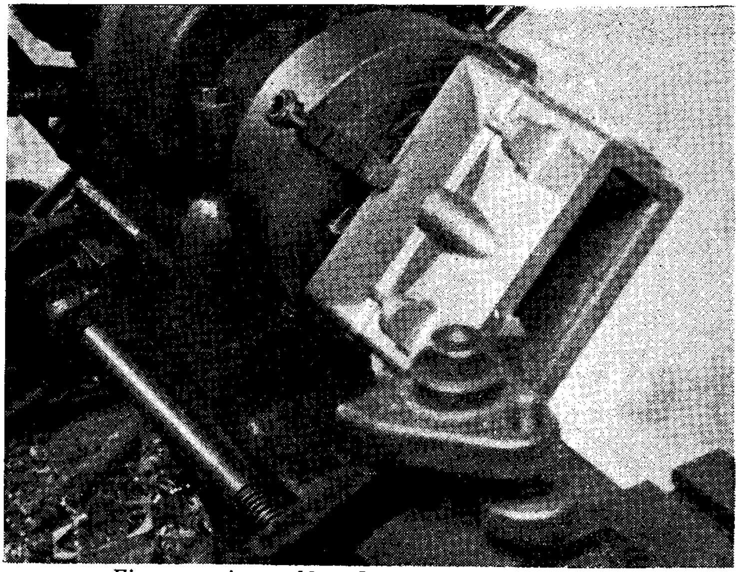
This requires only boring at the two ends, the rest being merely a clearance hole cored integral with the inside of the casting. Whether the end-plate housings are bored on the faceplate or on the cross-slide, the camshaft tunnel is most suitably dealt with by setting the casting over the required amount. It is easy to do this in the former case, simply by swinging the angle plate bodily on the faceplate, and this ensures true parallelism of the two bores. If the boring is done on the cross-slide, however, it must be completely re-set, and the packing under the base reduced by a thickness equal to the vertical height of the camshaft above the main centre, namely, 23/32 in. Care must be taken to ensure that the casting is re-set truly in line with the lathe centres and the use of an alignment bar or mandrel through the bore of the housings would be useful in this respect. The vertical and horizontal offset measurements from the camshaft to the main centre are not highly critical, as the meshing of the gears can be adjusted by the position of the idler gear, but it is best to get them as accurate as possible, on the general principle that good work is easier than bad, because it cuts out the necessity for subsequent "botching" to correct earlier mistakes.

Boring Cylinder Seatings

This is a highly important operation, as the dimensions, squareness and location of the bores must all be correct. The cored holes should be plugged and the centre line of each very carefully marked, but once the first bore has been located, it is easier and generally more accurate to locate the others by measurement.

If the lathe will swing the casting at maximum eccentricity, that is, when boring either end seating, it may be bolted to the faceplate, using the same means as before, but in this case, some measures are necessary to avoid damaging the finished bores of the housings. A piece of soft wood packing under each end of the strap will serve this purpose. Before mounting the casting, however, one side of the casting, at the base, should be filed straight, and parallel with the centre line, to make contact with an alignment strip for use in locating the bores.

Having lightly attached the casting to the faceplate, set it so that one of the bore centres runs dead truly, and tighten the bolts holding it in place. Before proceeding further, clamp the alignment strip (any piece of bar or strip material having a dead straight edge) to the faceplate, in contact with the prepared side of the casting. The bore may now be machined to size, using a stiff boring tool and taking care to ensure parallelism, or rather equal diameter of the upper and lower seatings. At all costs, tapering "the wrong way"—larger at the lower seating—must be avoided. If a reamer or sizing cutter is available it may be used to finish the bores to ensure uniformity of size, but it should not take out more than about two or three thousandths of an inch on the diameter. The counterbore at the top end is of course machined at the same setting, and if any metal has been left on the top joint face for final machining, this should be allowed for in assessing the depth of the counterbore.



First operation on block : facing sump joint surface

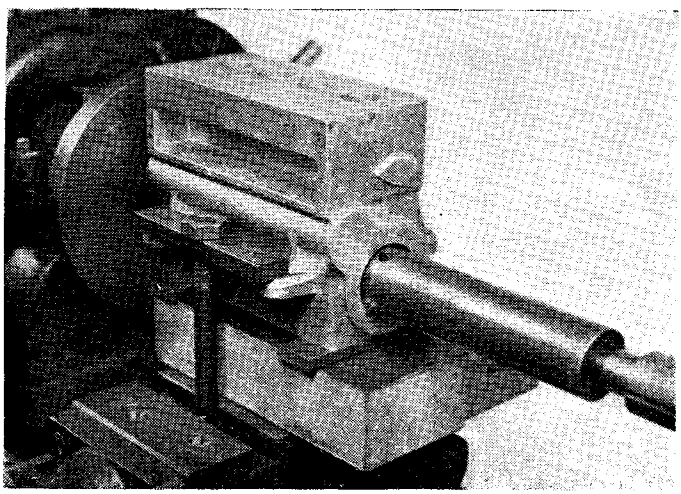
After machining one bore, the casting must be shifted exactly the centre distance to the next bore ($\frac{7}{8}$ in.), keeping it in close contact with the aligning strip. The distance may be measured by any convenient means, such as a depth gauge from the edge of the faceplate, or it may be located by reference to the marked-out centre, but for positive accuracy there is nothing to beat the use of a slip gauge and stop piece. A disc of metal exactly $\frac{7}{8}$ in. diameter may be used as the gauge, which is placed in contact with the end face of the work (while in its original location) and the stop piece clamped to the faceplate, so that the gauge is just free to move in between the two, without shake. The gauge is then removed, the work loosened, and slid along the alignment strip until it makes contact with the stop piece, then re-bolted for machining the next bore. This procedure is repeated for locating subsequent bores, and will ensure that they are all dead in line, equally spaced, and axially parallel.

For machining the bores on a lathe too small to swing the casting, the latter may be mounted on an angle plate bolted to the cross-slide, due care being taken to set the angle plate dead square with the lathe centres, or parallel with the faceplate, which is the same thing. After locating the first bore, the same methods of relocating for subsequent bores may be employed. If a set boring bar is used, all bores will be uniform in size and exactly parallel ; a second cutter may be mounted in the bar, if desired, to machine the counterbore at the same setting. As it is impossible to run the bar between centres, the overhung cutter may spring to some extent, so it is advisable to take several traverses through each bore, with a slow feed, to eliminate any possible errors from this source. Saddle boring should always be done with the cross-slide locked or very stiffly adjusted, and the saddle gibs set so that they allow no perceptible shake.

Valve Ports

The setting up and machining of these may be carried out on similar principles to that of the cylinder seatings, with the difference, however, that they are drilled from solid metal. One point which must be carefully watched is the tendency of the drill, after breaking out into the cored recess, to run out of truth when starting to work on the lower part of the hole. This can be avoided by drilling the upper part undersize, and then using a stiff pilot drill, a tight fit in the hole, to start the lower part. The drill may be made from silver-steel, flattened and diamond-pointed at the extreme end only, and it should be lubricated on the shank to avoid risk of seizing in the pilot bore. As there are

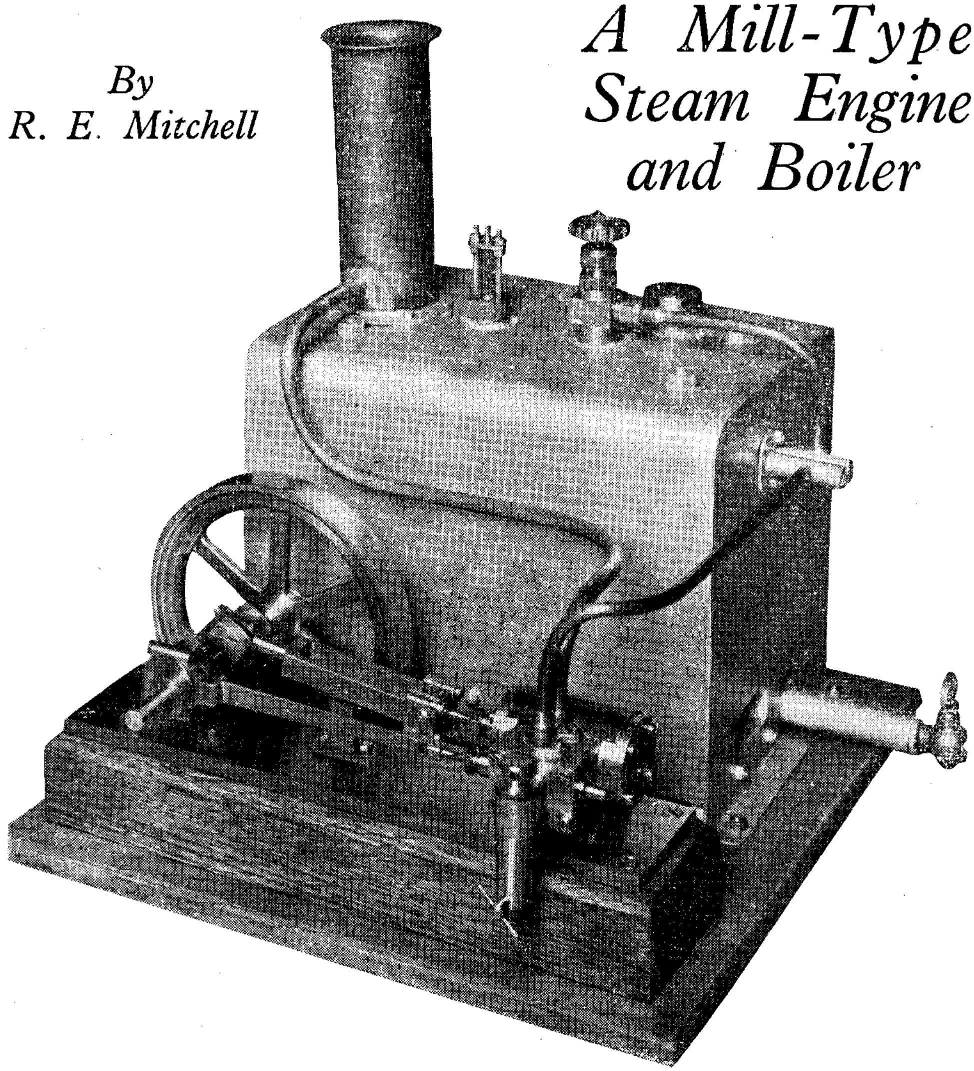
(*Continued on page* 285)



Boring the endplate housings with a boring bar between centres

A Mill-Type Steam Engine and Boiler

By R. E. Mitchell



HAVING a small nephew, aged $9\frac{1}{2}$ years, for whom a present had to be found, I hit on the idea of making a small stationary steam engine and boiler for driving other models, which he could make for himself.

For the sake of speed, a set of castings were obtained for the engine from Mr. A. J. Every, of Ealing.

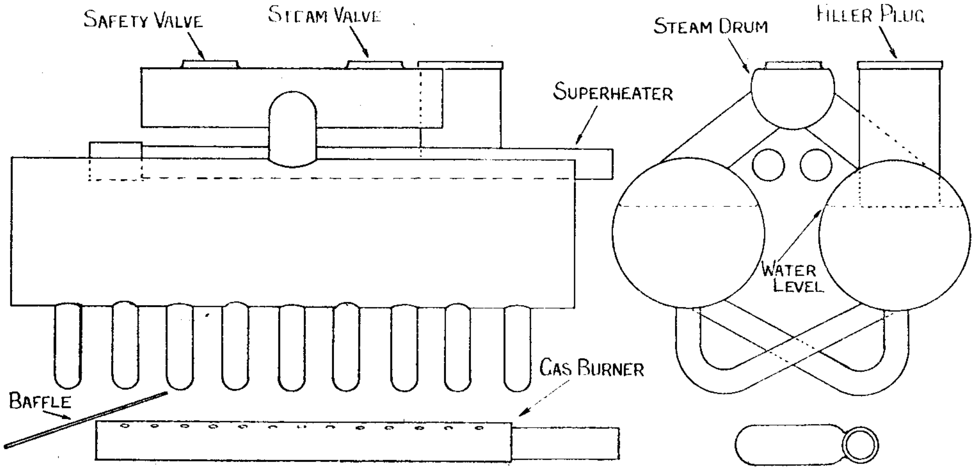
The photograph shows all the details of the engine, the cylinder of which is $\frac{3}{4}$ in. bore $\times$ 1 in. stroke, and is of very simple construction. The crankshaft is of mild-steel and was made by pressing the journals and the crank pin into the crank webs, and pegging as an extra safeguard. It may be of interest that pegs made from 14-s.w.g. cycle spokes are a driving fit in 5/64 in. diameter drilled holes. This is a method I have not used before, and it can be recommended.

The crosshead is also similarly pegged on to the 5/32-in. diameter stainless-steel piston-rod, to which the roughed-out bronze piston was silver-soldered and the whole turned at one setting. The piston and all glands are packed with graphited asbestos.

The Boiler

This is made entirely of 16-s.w.g. copper tube, as shown in the sketch, and consists of two longitudinal water drums each $7\frac{1}{2}$ in. long $\times$ 2 in. diameter, connected by nine $\frac{1}{4}$-in. bore water-tubes. Steam is collected from the top of each drum by two $\frac{9}{16}$-in. bore tubes leading into a 1-in. diameter steam drum which is flattened along the top to receive the safety-valve and steam-valve bushes.

The filler tube enters one of the water drums for about a third of its diameter to form an air lock and so prevent overfilling of the boiler, one



GENERAL ARRANGEMENT OF BOILER

filling of which lasts for fifty minutes under normal conditions.

The superheater, which is placed between the water drums, consists of two parallel $\frac{5}{16}$-in. bore copper tubes fitted with a return bend, as per "L.B.S.C." The whole of the boiler is brazed.

The fittings consist of a safety-valve, set to blow off at 35 lb./sq. in., fitted with stainless-steel ball and spring, and a steam-valve so constructed that its stainless-steel spindle cannot be screwed out, a requirement which considerably complicates construction but is desirable, considering the age of the recipient, which also ruled out the fitting of a water gauge whose glass might easily be broken. A pressure gauge was similarly thought to be an unnecessary refinement.

Since the photograph was taken a lever has been added to the safety-valve in order that the spring may be lifted to ensure that the ball is not sticking.

The boiler is housed in an asbestos-lined steel case, being suspended from the top by four screws, the nuts of which can be seen in the photograph, brazed on to the water drums.

The firing is by coal gas fed into a gas-ring type burner, the air hole of which is on the other side of the tube in the picture and is non-adjustable. The gas tap is fitted with a bypass to prevent the burner being accidentally turned out and to provide sufficient for average running.

When first tested, it was found that water from the exhaust, which is led up the chimney, extinguished some of the gas jets immediately below. This was overcome by fitting a small stainless-steel baffle plate set at an angle, as shown.

Petrol Engine Topics

(*Continued from page* 283)

eight ports to drill, the making of a simple tool of this kind is worth while. The holes should be opened out and reamered, the lower part being $\frac{1}{4}$ in. diameter, and the upper part $\frac{5}{16}$ in., with a counterbore $\frac{3}{8}$ in. dia. by $\frac{1}{16}$ in. deep.

It is quite practicable to machine these ports in the drilling machine if great care is taken in locating the centres, and keen, true running drills are used. A special sizing and counterboring cutter may be made for finishing the bores. But generally speaking, more positive accuracy is obtained by machining them in the lathe, with proper means of setting up or locating, as already described.

Breather Orifice

It will be seen that the centre line of this is set at an angle of 20 degrees to the vertical, the exact angle not being critical, and the best way to machine it, in the absence of an adjustable angle plate, is to plane up a piece of wood to the required angle, and use this as a packing piece to mount the casting on the faceplate. The strap and bolts may again be used to secure it, with the wooden pads to avoid marking the housings; the latter allow of a rocking or "self-aligning" motion, so that a good bearing of the strap is obtained. Centre the boss of the breather as exactly as possible, then face the top surface, drill truly and tap or screwcut to $\frac{7}{16}$-in. fine thread.

Other machining operations on this casting are quite simple and obvious. The side face of the valve chamber is best machined by face milling, which may be done by bolting it on the cross-slide and using a fly-cutter in the lathe chuck. Mark out the cross holes for the valve passages exactly in line with the vertical ports; but it is advisable to defer the drilling of them until the valve liners are inserted.

The undersides of the bearers should be milled if possible, and the best way to do this is by mounting the casting on a vertical slide and using an end mill. The surface should be exactly level with the shaft centre line, to facilitate lining up when the engine is installed.

(To be continued)

QUERIES AND REPLIES

Enquiries from readers, either on technical matters directly connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed "Queries and Service," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of a specialist, or outside consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 8001. Boat Building Methods. G.H. (Bromley)

Q.—I wish to construct a one-metre (approx.) model of the hull of a 30- or 40-ft. speed boat. My main hobby is woodwork, and I am a novice as far as model boat building is concerned.

I have examined a number of sets of drawings and instructions dealing with the type of boat I require, but whilst hull cross-section, etc., are given, it appears to be assumed in all cases that one knows how to set about it.

I do not know if one ever considers carving such a hull from the solid, but in any case I wish to build it up, either in wood or metal. What I have in mind is thin wood or sheet metal applied to a wood frame.

Can you supply me with or tell me where I can obtain the necessary detail drawings of parts and instructions?

R.—There are several possible methods of constructing model boat hulls, all of which are quite successful, but the method most suitable in any particular case will depend on the purpose for which the boat is to be used. The most popular methods are (1) carving from solid wood; (2) "Bread and Butter" or laminated wooden construction; (3) framing and planking; (4) framing with veneer or three-ply skin; (5) wood framing with metal plating; (6) all-metal construction; these methods do not by any means exhaust the possibilities, but it may be mentioned that for model speed boat hulls, methods (3) and (4) are generally favoured, as these result in the lightest and strongest structure.

Articles on boat construction appear at frequent intervals in THE MODEL ENGINEER, in which examples of all the above methods of constuructions are described in detail.

No. 8002. Low-Tension Ignition. P.W. (Pirbright)

Q.—I have recently read a description of a method of ignition which was used in early petrol engines, and works on low tension current. Would this be suitable for application to model I.C. engines?

The circuit consists of a battery connected through a switch to a choking coil, which consists of "a bundle of soft iron wires, with a coil of insulated copper wire wound round it." The other end of the coil is connected to a contact-breaker which is actually inside the cylinder head. This opens and shuts, thus producing the spark.

Is this too obsolete to be of any use? It was usually used for large stationary engines, but it could probably be made cheaper and lighter than the high tension type.

R.—The system of low-tension ignition referred to is well known, and is still used to a limited extent on large slow-speed engines at the present day. As it employs a "current" spark or "arc," the energy required is considerably greater than that of spark ignition, especially in view of the resistance set up by corrosion and carbon deposit on the internal contact points. It is rather sluggish in action, and has never been very successfully used on high-speed engines, besides which it is extremely difficult to prevent compression leakage around the spindle of the contact-breaker. An attempt has been made to avoid this by operating the contacts electro-magnetically, but it may be taken that there were excellent reasons why this system was superseded in favour of the high-tension spark system.

No. 8003.—"M.E." Spray Gun. G.R. (Stansted)

Q.—I have made up an "M.E." paint spray gun, but am not too sure of the jet and nozzle sizes, or whether they are flared or parallel, as I have lost the specification. Could you please let me know these sizes, also at what speed a compressor $1\frac{1}{4}$-in. bore × $1\frac{1}{2}$-in. stroke should be run at to supply the air.

R.—The sizes of air and spray nozzles in the "M.E." spray gun will depend on the air capacity available, and the volume of spray or rate of covering surface required. For fine work, using a compressor of about the size you specify, running at about 500 r.p.m., we suggest that a No. 60 drill should be used for the air jet, and from 50 to 55 for the spray nozzle. If it is found that the compressor will not maintain a high enough pressure for the required purpose, it is obviously necessary to reduce the size of the air jet. Parallel holes in both air jet and spray nozzle will be found satisfactory, but there is scope for experiment in the shape of these holes and their length in relation to bore.